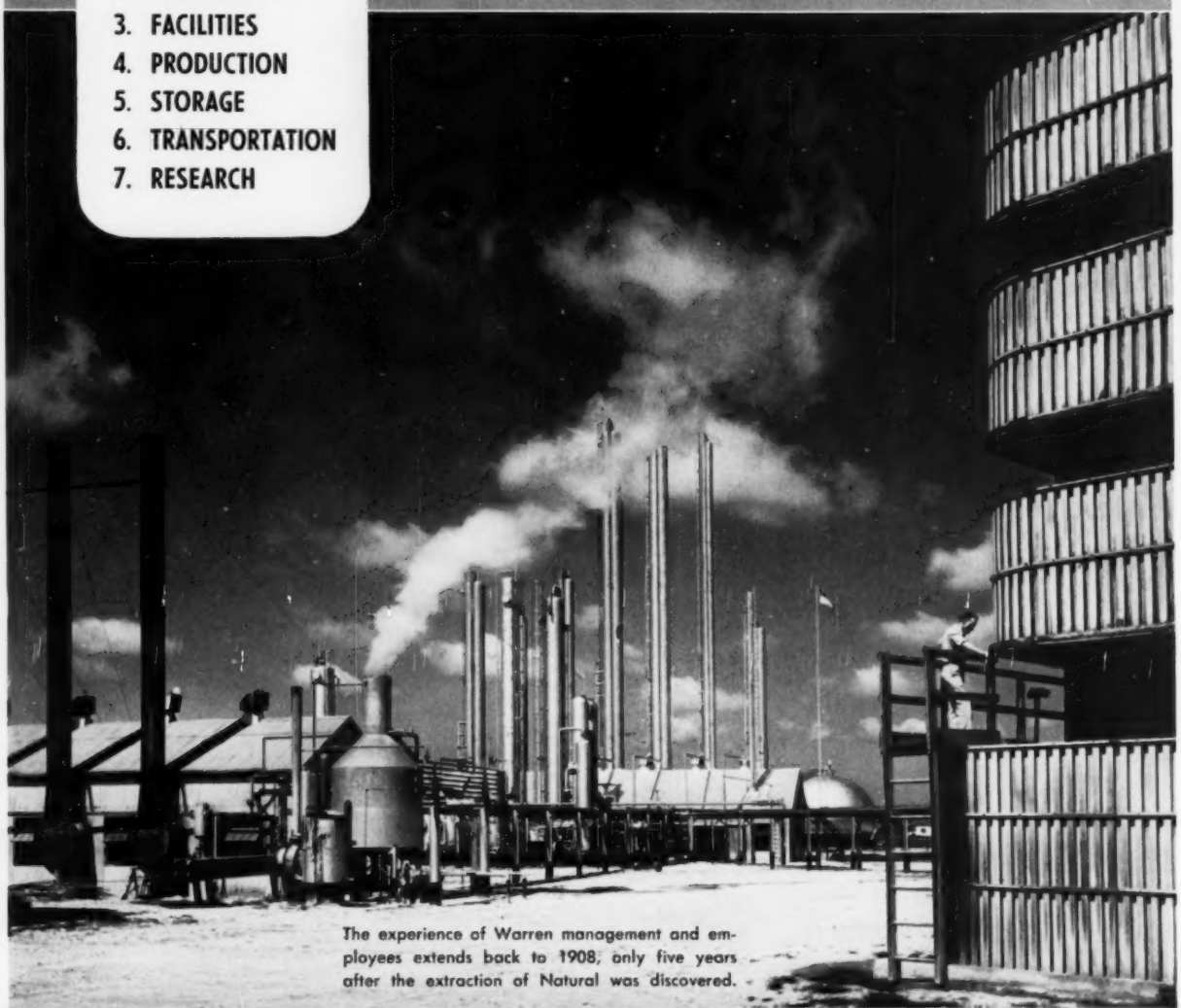
# World Petroleum

FIVE DOLLARS PER YEAR **MARCH, 1949** FIFTY CENTS PER COPY

# 7 Reasons WHY IT'S WARREN

1. PERSONNEL
2. EXPERIENCE
3. FACILITIES
4. PRODUCTION
5. STORAGE
6. TRANSPORTATION
7. RESEARCH



The experience of Warren management and employees extends back to 1908, only five years after the extraction of Natural was discovered.

## WARREN PETROLEUM CORPORATION

Producers, Manufacturers, Exporters and Marketers

Export Terminals: Corpus Christi, Port Arthur, Baytown, Texas City, and Norsworthy, Houston, Texas.

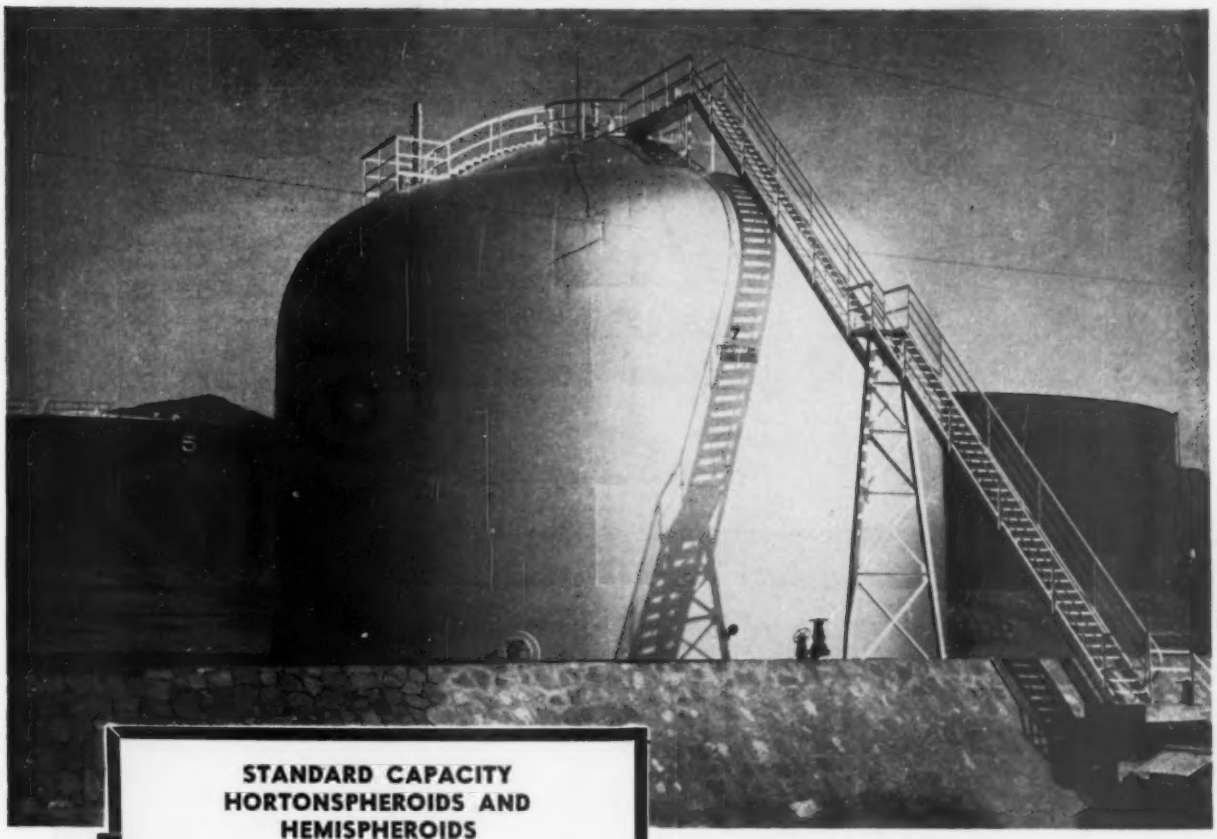
TULSA 2, OKLAHOMA CABLE ADDRESSES: Stavolene, Warren

WARREN'S CROSSVILLE, ILLINOIS PLANT

*Crude Oil, Natural Gasoline and Liquefied Petroleum Products*

# LOW-COST STORAGE

**for motor gasolines . . .**
**for aviation gasolines . . .**



## STANDARD CAPACITY HORTONSPHEROIDS AND HEMISPHEROIDS

Indicating type of vessel furnished for various pressures.

| Capacity in Barrels | Working Pressure, Pounds per Square Inch | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2½ | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 75 | 100 |
| 2,000 | PH | PH | PS | PS | PS | PS | PS | PS | PS | PS | PS | PS |
| 2,500 | PH | PH | PS | PS | PS | PS | PS | PS | PS | PS | PS | PS |
| 5,000 | PH | PH | PS | PS | PS | PS | PS | PS | PS | PS | PS | |
| 7,500 | PH | PH | PS | PS | PS | PS | PS | PS | PS | PS | PS | |
| 10,000 | PH* | PS | PS | PS | PS | PS | PS | PS | PS | PS | | |
| 15,000 | PH* | PS | PS | PS | PS | PS | PS | PS | PS | | | |
| 20,000 | PH* | NS | PS | PS | PS | PS | PS | PS | PS | | | |
| 25,000 | NH | NS | NS | PS | PS | PS | PS | PS | | | | |
| 30,000 | NH | NS | NS | PS | PS | PS | PS | PS | | | | |
| 40,000 | NS | NS | NS | NS | PS | PS | PS | PS | | | | |
| 50,000 | NS | NS | NS | NS | NS | | | | | | | |
| 60,000 | NS | NS | NS | NS | NS | | | | | | | |
| 80,000 | NS | NS | NS | NS | NS | | | | | | | |
| 100,000 | NS | NS | NS | NS | NS | | | | | | | |
| 120,000 | NS | NS | NS | NS | NS | | | | | | | |

PH—Plain Hemispheroid
NH—Noded Hemispheroid
PS—Plain Hortonspheroid
NS—Noded Hortonspheroid

* Noded-Type Hemispheroid can be furnished if desired.

## *Horton* HEMISPHEROIDS

### operate at low pressures . . . reduce evaporation losses

For the storage and handling of gasoline and other volatile liquids requiring pressures up to 5 lbs. per sq. in., the Horton Hemispheroid provides a positive form of protection against evaporation losses that is both dependable and economical. Here are some of the advantages of the Hemispheroid which make it reliable: (a) positive protection—no evaporation loss will occur as long as the pressure in the vapor space is below the relief valve setting; (b) simplicity of operation—unaffected by climate and requires only nominal maintenance; (c) durability—saturated air-vapor mixture reduces interior corrosion; and (d) fire safety—air-vapor mixture inside tank is too rich most of the time to be flammable.

These same advantages also belong to the Hortonspheroid, which operates in a similar manner at higher pressures. The table at the left shows capacities and pressure ranges for both types. More information is available from our nearest office.

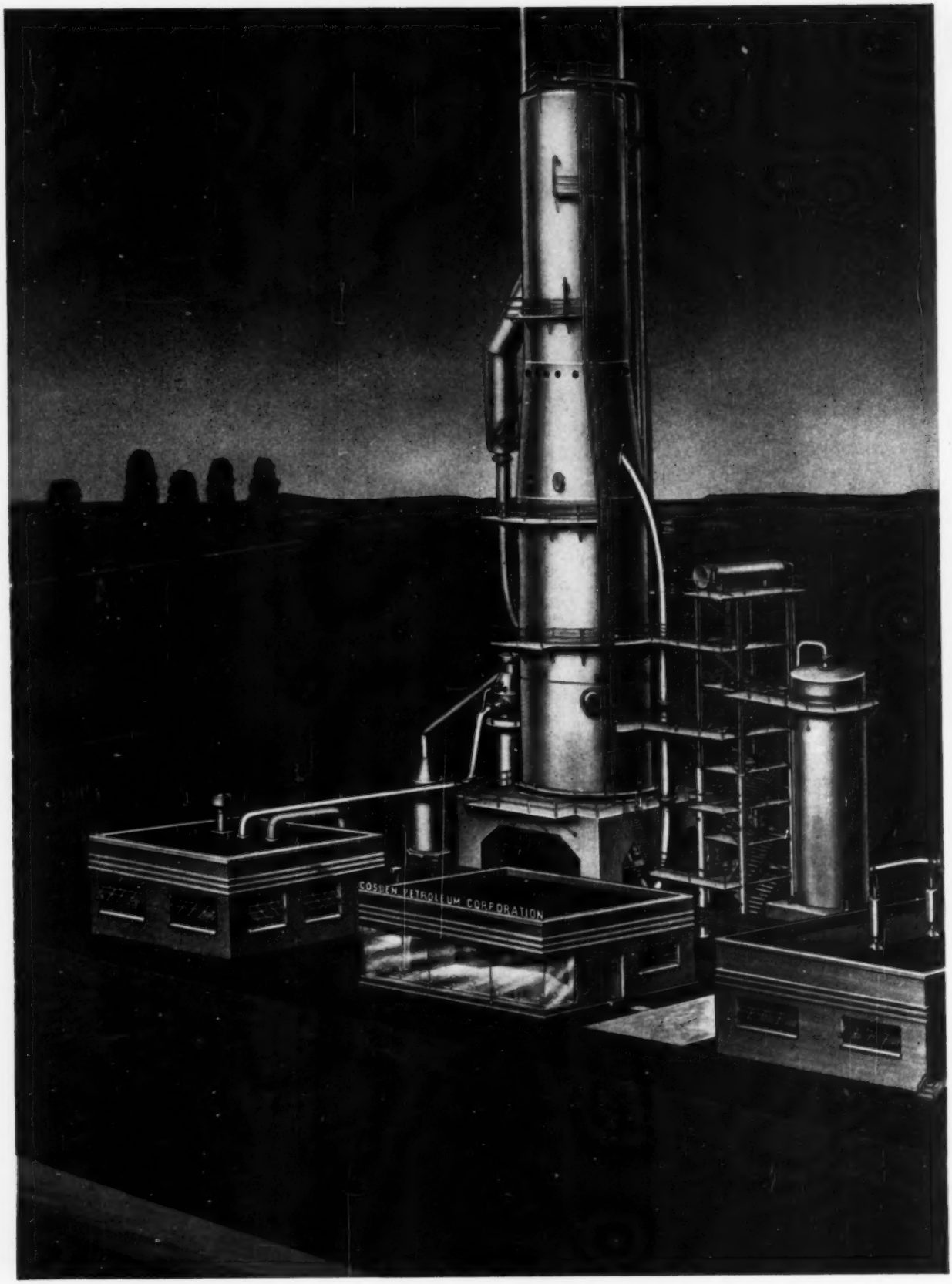
*Above: A 30,000-bbl. noded-type Hemispheroid used to store motor gasoline at the Antofagasta plant of the Esso Standard Oil Company (Chile) S. A. C. It operates at 2½ lbs. per sq. in. pressure.*

## CHICAGO BRIDGE & IRON COMPANY

**Sales Offices: Chicago, Houston, Tulsa, San Francisco, Birmingham, Atlanta, Cleveland, Philadelphia, Los Angeles, Detroit, Boston, Seattle and Salt Lake City**
**Plants: Birmingham, Chicago, Salt Lake City and Greenville, Pa., U.S.A.** **Export Office: 165 Broadway Building, New York 6, N. Y., U.S.A.**

**REPRESENTATIVES AND LICENSEES**

Ateliers et Chantiers de la Seine Maritime, Paris, France
Constructions Metalliques de Provence, Arles-sur-Rhone, France
Compania Tecnica Industrie Petroli, S.A.I. Rome, Italy
Whessoe, Limited, Darlington, England
Motherwell Bridge & Engineering Company, Limited, Motherwell, Scotland
Horton Steel Works, Limited, Fort Erie, Ontario, Canada
Chicago Bridge & Iron Company, Ltd., Apartado 1348, Caracas, Venezuela

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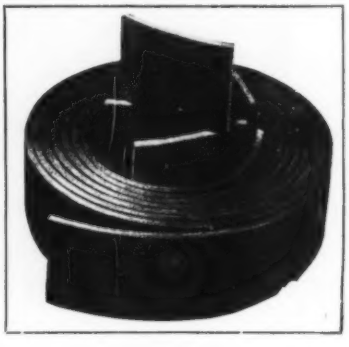
COSDEN'S
(Big Spring, Texas)
NEW FLUID "CAT" CRACKER
Constructors
THE REFINERY ENGINEERING COMPANY
Licensors
UNIVERSAL OIL PRODUCTS COMPANY
Charge capacity, 6,000 barrels daily of West Texas sour gas oils. Construction started January 1, 1949. Expected completion date, December 1, 1949.
TRECo
The REFINERY ENGINEERING Co.
Phone 5-5561
Tulsa, Oklahoma

# A GOOD PERFORMANCE . . . if you use

## the world's best friction linings

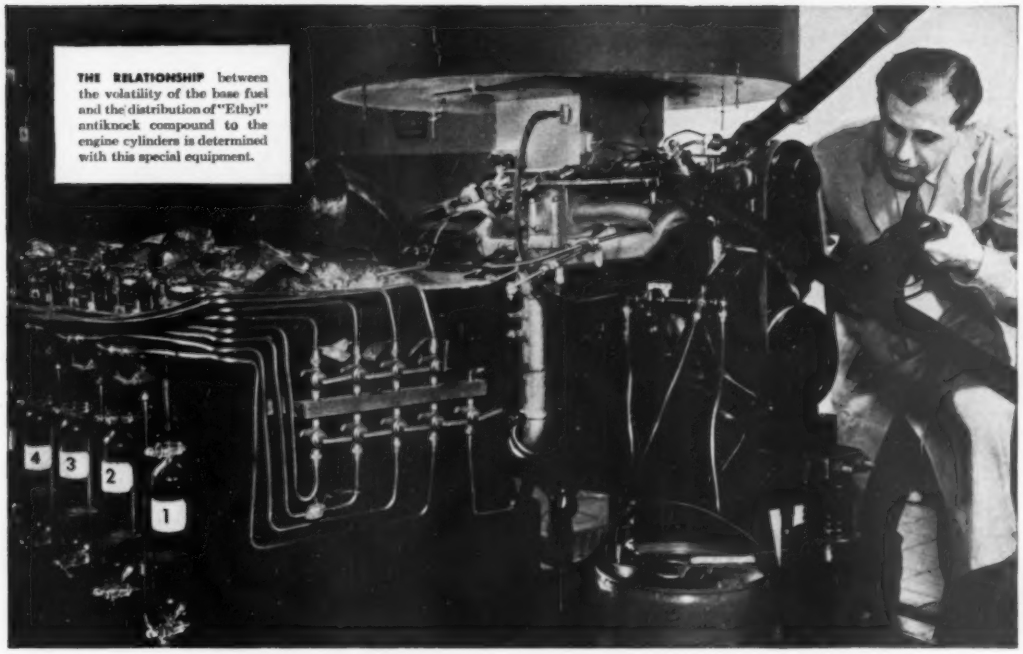
# FERODO

REGD. TRADE MARK FERODO



*Agents for*—**ARGENTINE, URUGUAY and PARAGUAY :** Anderson Levanti & Co., S.R. Ltda. Alsina 471/485, Buenos Aires. **PERU :** Milne & Co., S.A., Lima. **CHILE :** Balfour Lyon & Co., Ltd., P.O. Box 2-V., Valparaiso. **TRINIDAD :** F. J. Miller & Co., 30, Richmond Street, Port of Spain. **INDIA :** Asbestos Cement Limited, Mulund, Bombay. **BURMA :** Foucar & Co., Ltd., 554, Merchant Street, P.O. Box 148, Rangoon. *FACTORY REPRESENTATIVE : Caribbean Area*—C. L. Sharp, Esq., c/o Ferodo Ltd., Chapel-en-le-Frith, Stockport, England. *Central Europe*—P. H. Greve, Esq., Casella Postale 534, Trieste Centro, Free Territory of Trieste. *Far East*—H. C. Sturgess-Wells, Esq., c/o Hong Kong and Shanghai Banking Corporation, Hong Kong. **CANADA and U.S.A.** : *Enquiries to :* Atlas Asbestos Co., Ltd., 110, McGill Street, Montreal, Canada.

Manufacturers : FERODO LTD., CHAPEL-EN-LE-FRITH, STOCKPORT, ENGLAND. A Member of the Turner and Newall Organisation.




**THE RELATIONSHIP** between the volatility of the base fuel and the distribution of "Ethyl" antiknock compound to the engine cylinders is determined with this special equipment.

# REAPPRAISING FUEL VOLATILITY

THERE are some refiners who have an excess of high-volatility stocks of good antiknock quality. There are others who, because of the use of new refining processes, may find it advantageous to produce quantities of high-antiknock stocks of relatively low volatility. The ability of such refiners to blend these stocks into motor gasoline might result in greater flexibility and economy of refinery operation.

The needs of automotive transportation are served best by the greatest possible flexibility in the refining of petroleum products. It is desirable, therefore, that automotive designers make every effort to minimize the sensitivity of engines to fuel volatility.

The problem of using gasolines that contain high-boiling fractions, in particular, presents a challenge to the automotive engineer, because it is not desirable that distribution to the cylinders be obtained through excessive heating of the intake manifold. Such heating not only reduces volumetric efficiency and power output, but tends to depreciate the antiknock quality of highly sensitive cracked fuels.

### *Problems of vapor-lock*

The use of gasolines containing the lighter hydrocarbons also presents problems of engine design. High-volatility gasolines, under some conditions of service, may result in vapor-lock of fuel systems, but experience indicates that much can often be done in the design of both engine and chassis to increase their tolerance of more volatile fuels. When engines and vehicles can utilize the lighter fuels without the occurrence of vapor-lock, the advantages of easier starting and quicker warm-up are made available to users of automotive vehicles.

Volatility of gasolines is an important factor in connection with the formulation and utilization of "Ethyl" brand of antiknock compound. As a consequence it has played and will continue to play an important part in the program of the Ethyl Research Laboratories.

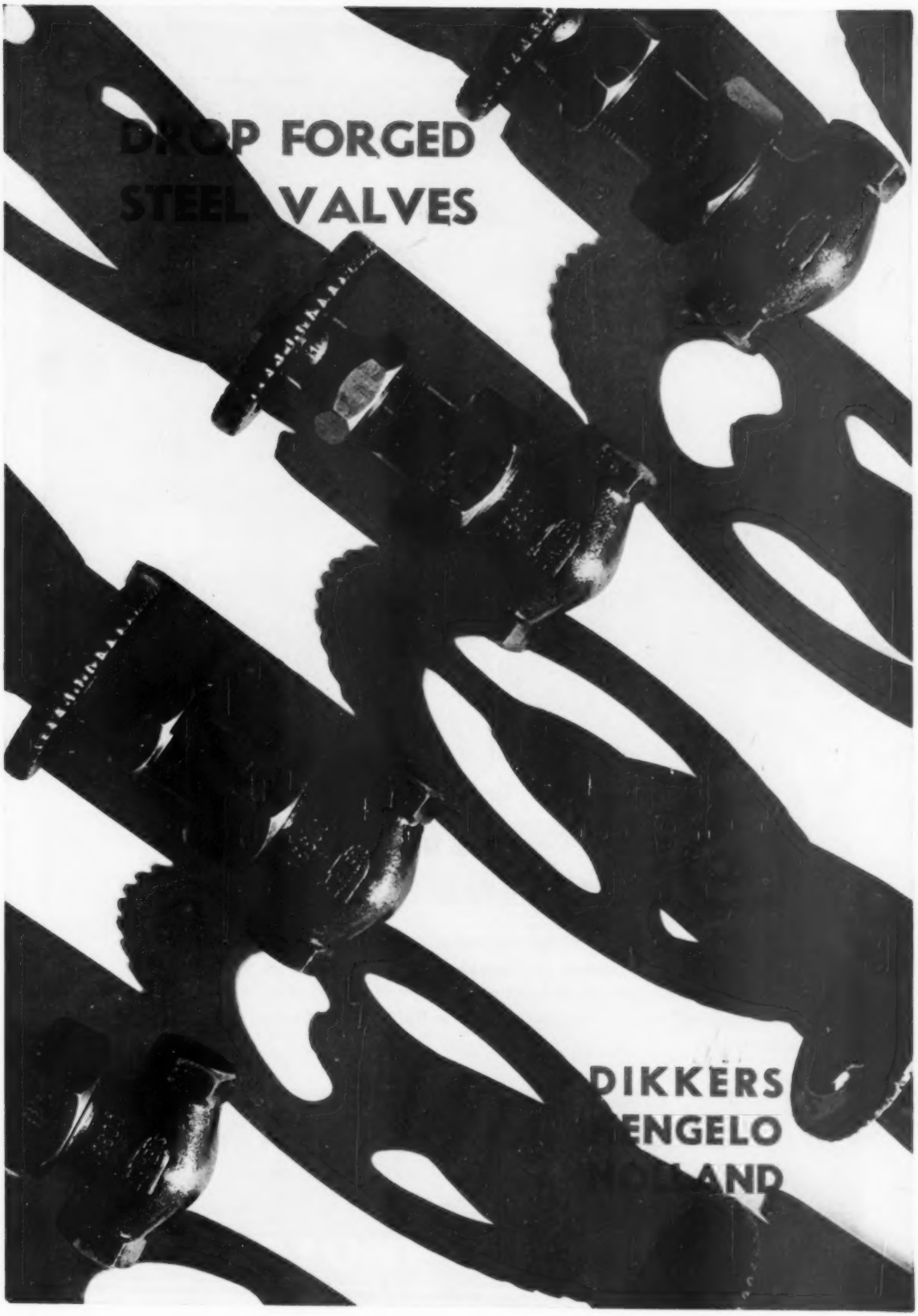
Research related to gasoline volatility is only one of the many services provided by the Ethyl Laboratories for oil companies. A comprehensive and continuous research program provides information which assists refiners directly in the economical production of satisfactory gasoline and furnishes basic data which serve as a foundation for development programs related to gasolines, engines, and crankcase oils.

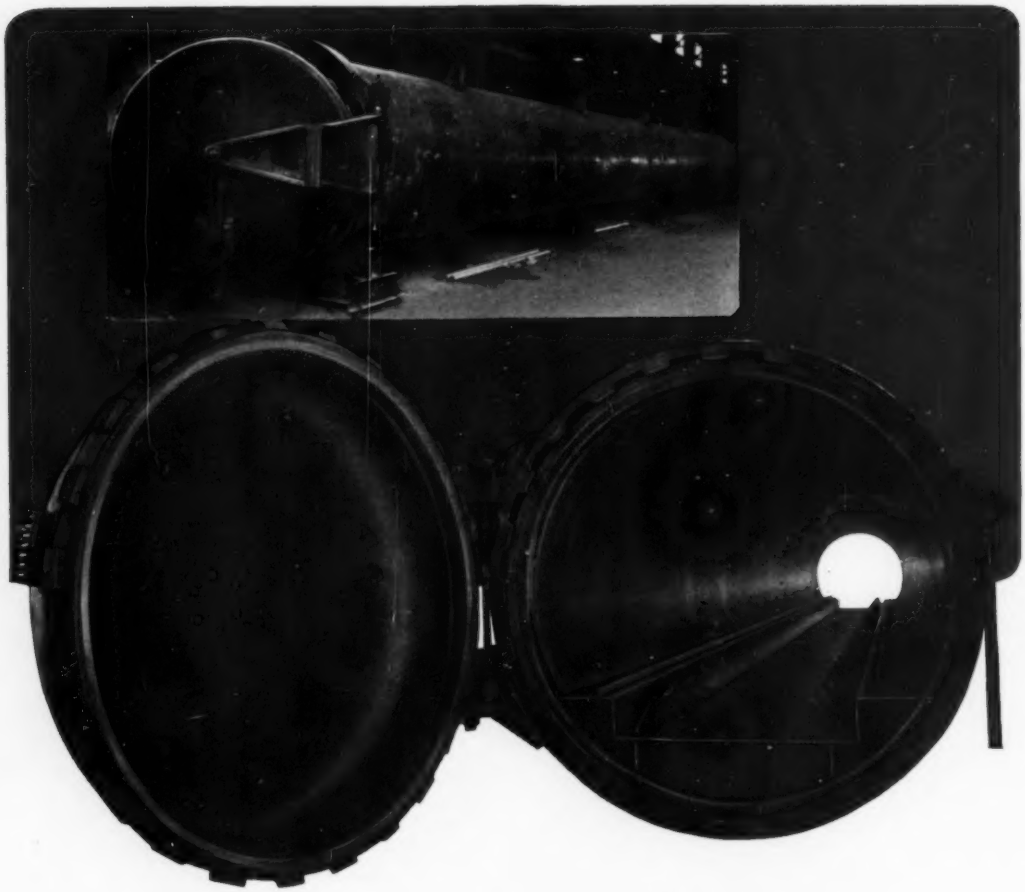
*Serving the Progressive Petroleum Industry Through Research*

**ETHYL CORPORATION**
**RESEARCH LABORATORIES**

Detroit, Michigan, 1600 West Eight Mile Road • San Bernardino, California, 2600 Cajon Road

SPECIAL EQUIPMENT
for Oil Refineries and
Chemical Plants
Towers...kilns...tanks...reactors...other pressure vessels of alloy and ordinary steel...are but a few examples of Sun's ability to produce a wide range of equipment to exacting specifications. We invite you to consult with us on technical problems of construction.
You are likewise invited to take advantage of our extensive facilities for building, reconditioning or repairing tankers and cargo ships of every kind.
Sun
SHIPBUILDING & DRY DOCK COMPANY
SINCE 1916
ON THE DELAWARE • CHESTER, PA.
25 BROADWAY • NEW YORK CITY


DROP FORGED
STEEL VALVES
DIKKERS
ENGELO
AND



# *Autoclave* USED IN THE CHEMICAL INDUSTRY

**Manufactured for the Ruberoid Company, this Autoclave is 78 inches in diameter by eighty feet in length. Large and specialized equipment of this kind is handled as routine fabrication at the Dallas Tank Company, Inc.**

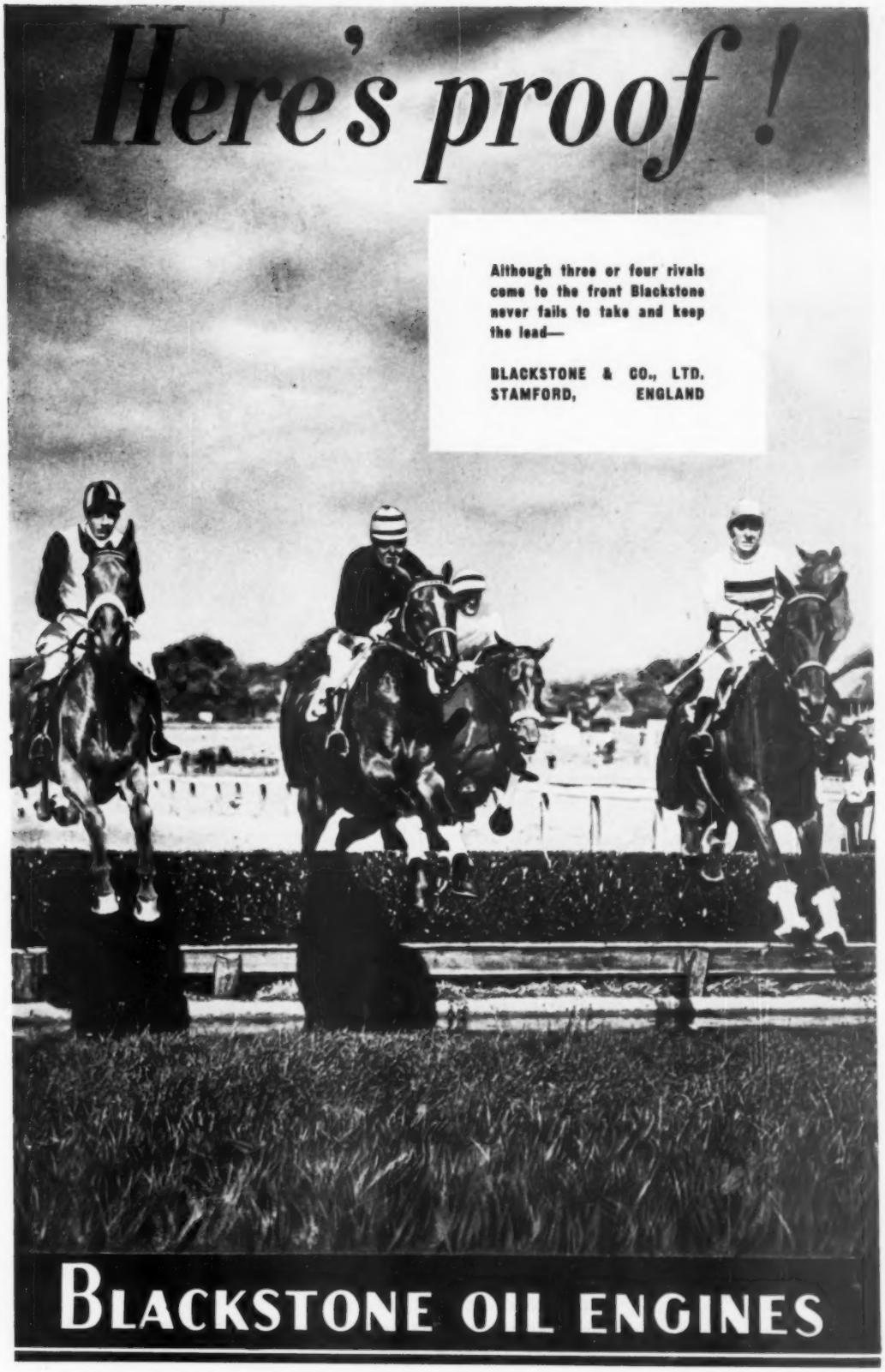
TANKS BY BANKS

**DALLAS TANK COMPANY, INC.**

201-5 W. Commerce Street • P. O. Box 5387

DALLAS, TEXAS

# *Here's proof!*



Although three or four rivals come to the front Blackstone never fails to take and keep the lead—

BLACKSTONE & CO., LTD.
STAMFORD, ENGLAND

**BLACKSTONE OIL ENGINES**

# What every new Tanker means to you

**If you are a farmer** *you see better crops.*

**If you are a housewife** *you see more convenience.*

**If you are a business man** *you see better transportation.*

Every day the world consumes more than *9 million barrels of oil—the biggest demand in history!* That is why every new tanker means so much. The farmer needs petroleum products for fueling his tractors and other mechanized equipment. Petroleum helps the housewife with heating, cooking and cleaning. The businessman sees gasoline as the "life blood" of motorized transportation. Today's demand for petroleum products on the farm, in the home and on the highway is the biggest in history. To help meet it, Standard Oil Company (New Jersey) and its affiliated companies are working night and day on a world-wide construction program.

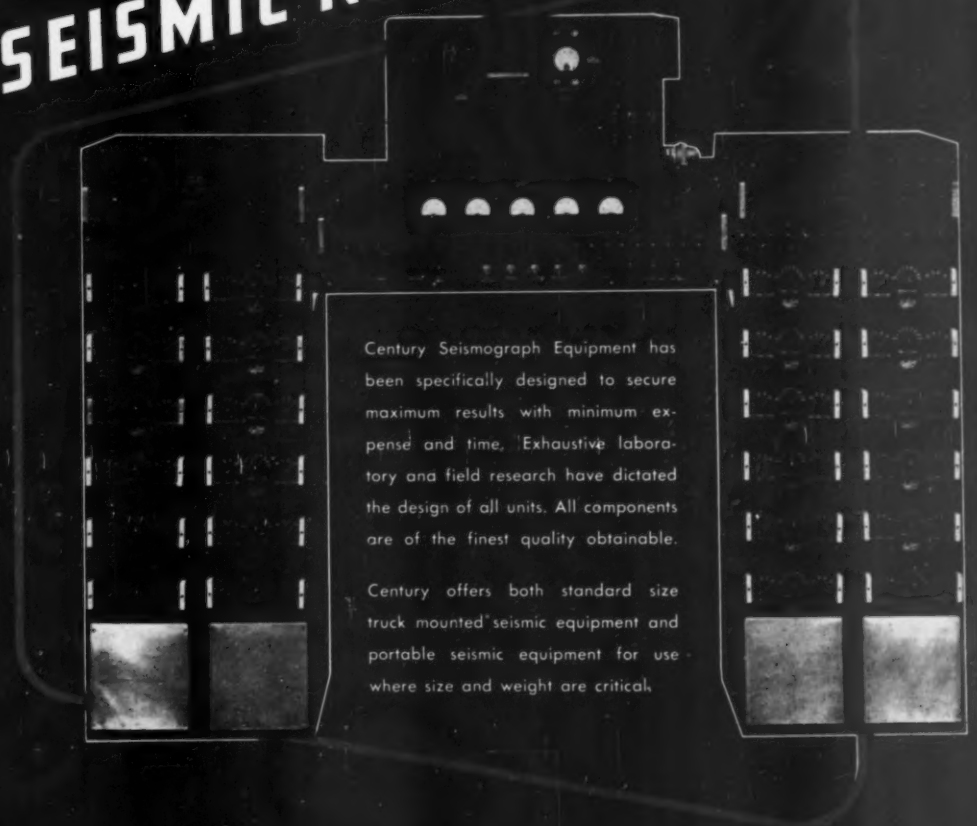
Tanker fleets are being expanded. New tankers, half again as large as those in general use, are being completed—some with a speed as high as sixteen knots. These will help greatly in delivering more oil where it is needed. New pipelines, refineries and storage tanks are also being built. When completed, this huge construction program will bring greater comfort and convenience to everyone, because...

***Petroleum helps to build a better life***

**STANDARD OIL COMPANY**
**(NEW JERSEY)**
**AND AFFILIATED COMPANIES**

# PERFECTION IN REFLECTION SEISMIC RECORDINGS

Century



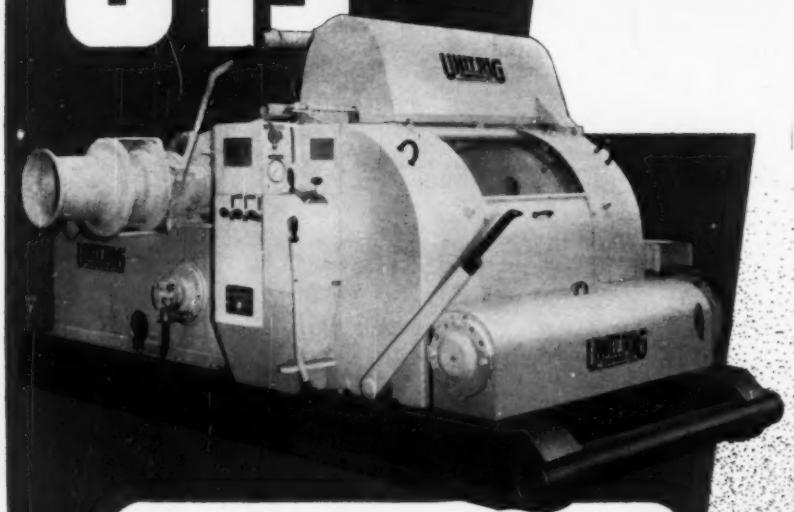
Century Seismograph Equipment has been specifically designed to secure maximum results with minimum expense and time. Exhaustive laboratory and field research have dictated the design of all units. All components are of the finest quality obtainable.

Century offers both standard size truck mounted seismic equipment and portable seismic equipment for use where size and weight are critical.

Century GEOPHYSICAL CORPORATION
TULSA, OKLAHOMA
149 Broadway, New York

LOOK AT ALL FOUR...

U-15



service

economy

portability

dependability

All Unit Rig models are designed so they can easily be moved on or off a location in a hurry. The "bugs" are taken out in tests run at the factory before any unit leaves, so you can depend upon Unit Rig for trouble-free service at the lowest possible cost. For drilling deep or shallow wells . . . you'll find a Unit Rig model that's designed for the job.

UNIT RIG & EQUIPMENT CO.
TULSA, OKLAHOMA U.S.A.

DESIGNED FOR THE JOB....

Exclusive Export Representative
MID-CONTINENT SUPPLY CO.
42 Broadway, New York City
Cable Address: MIDUNITRIG

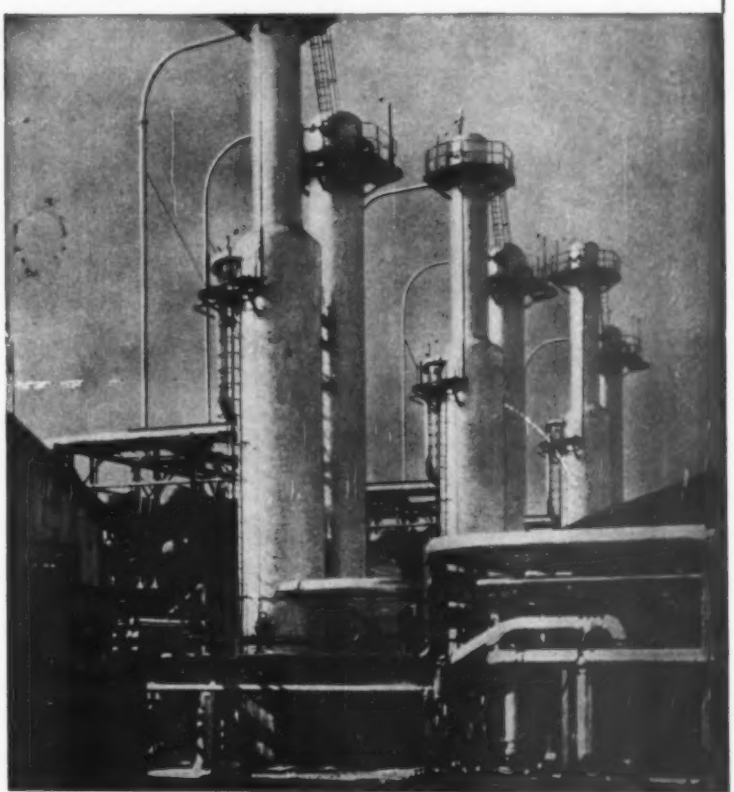
UR-A-11

# NEWALLS

## 85% Magnesia Insulation

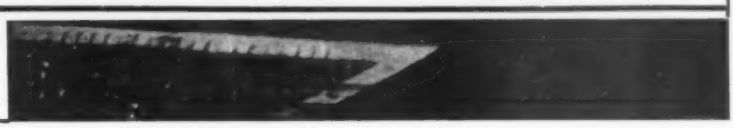
IS EXTENSIVELY USED ON THE CLASS OF WORK ILLUSTRATED. IT HAS AN EXTREMELY LOW THERMAL CONDUCTIVITY, IS LIGHT IN WEIGHT AND WILL MAINTAIN ITS EFFICIENCY THROUGHOUT THE LIFE OF THE PLANT. BEING EASY TO APPLY, ALSO INEXPENSIVE, IT IS IN ALL RESPECTS AN IDEAL COVERING FOR BOILERS, PIPES, HEAT EXCHANGERS, ETC. WRITE FOR OUR CATALOGUE "HEAT INSULATION" WHICH DESCRIBES ALL OUR HEAT INSULATING MATERIALS.

NEWALLS REGD BRAND PRODUCTS



## NEWALLS INSULATION CO. LTD.

WASHINGTON STATION
CO. DURHAM, ENGLAND



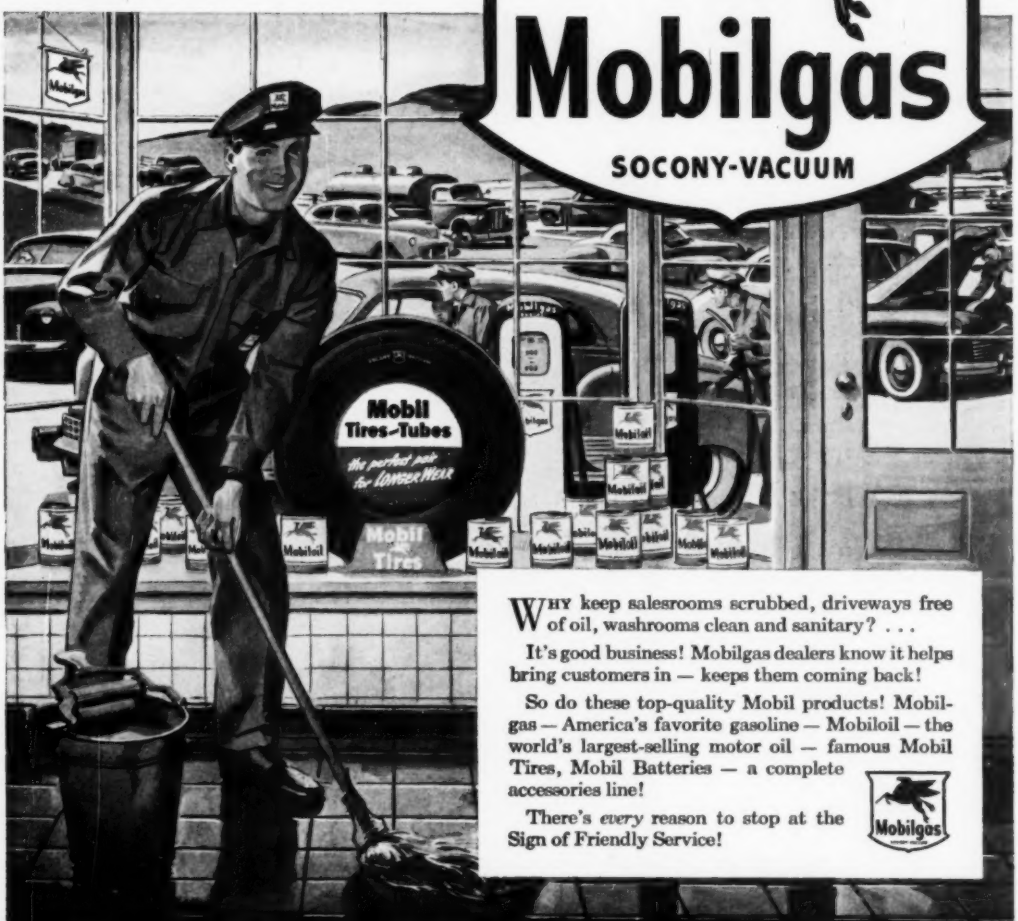
COULD IT BE THAT THIS IS ONE REASON

# Over 1,000 Cars a Minute Stop Here

*for Gas and Friendly Service?*

Mobilgas

SOCONY-VACUUM




WHY keep salesrooms scrubbed, driveways free of oil, washrooms clean and sanitary? . . .

It's good business! Mobilgas dealers know it helps bring customers in — keeps them coming back!

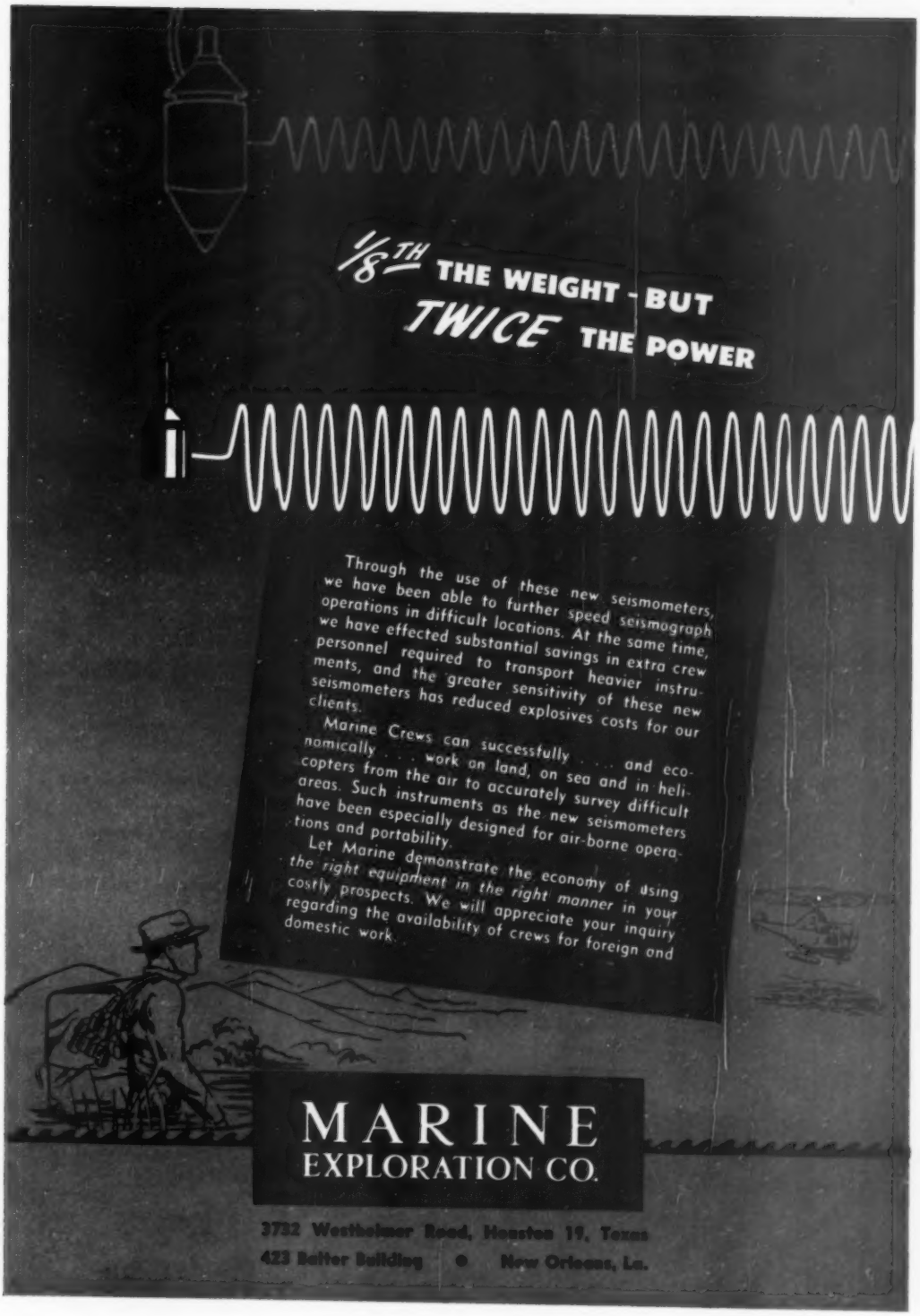
So do these top-quality Mobil products! Mobilgas — America's favorite gasoline — Mobiloil — the world's largest-selling motor oil — famous Mobil Tires, Mobil Batteries — a complete accessories line!

There's *every* reason to stop at the Sign of Friendly Service!

Mobilgas

## 82 YEARS' LEADERSHIP IN A PROGRESSIVE INDUSTRY — PETROLEUM

SOCONY-VACUUM OIL CO., INC., and Affiliates: MAGNOLIA PETROLEUM CO., GENERAL PETROLEUM CORP.


1/8TH THE WEIGHT - BUT
TWICE THE POWER
Through the use of these new seismometers, we have been able to further speed seismograph operations in difficult locations. At the same time, we have effected substantial savings in extra crew personnel required to transport heavier instruments, and the greater sensitivity of these new seismometers has reduced explosives costs for our clients.
Marine Crews can successfully . . . and economically . . . work on land, on sea and in helicopters from the air to accurately survey difficult areas. Such instruments as the new seismometers have been especially designed for air-borne operations and portability.
Let Marine demonstrate the economy of using the right equipment in the right manner in your costly prospects. We will appreciate your inquiry regarding the availability of crews for foreign and domestic work.
MARINE
EXPLORATION CO.
3732 Westheimer Road, Houston 19, Texas
423 Balter Building • New Orleans, La.

# American engineering practice

## *in Britain*

HEAD WRIGHTSON PROCESSES LIMITED are Accredited Engineers for Leading American Refinery Processes including Thermal and Catalytic Cracking and Reforming, Solvent Extraction and Dewaxing, Desulphurisation. Chemical Treating, Continuous Charcoal Adsorption, etc. . . . All plants engineered in strict accordance with American practice, and to American Codes. . . . Ten plants, including some of the largest Solvent Extraction Plants in the World, engineered by Head Wrightson Processes Ltd., are now in course of construction. Our services comprise engineering, purchasing, progressing, inspection, shipping, and supervision of erection.

## *Head Wrightson Processes Ltd.*

TEESDALE HOUSE 24-26 BALTIC STREET LONDON E.C.1

# Past masters in every step of refinery construction

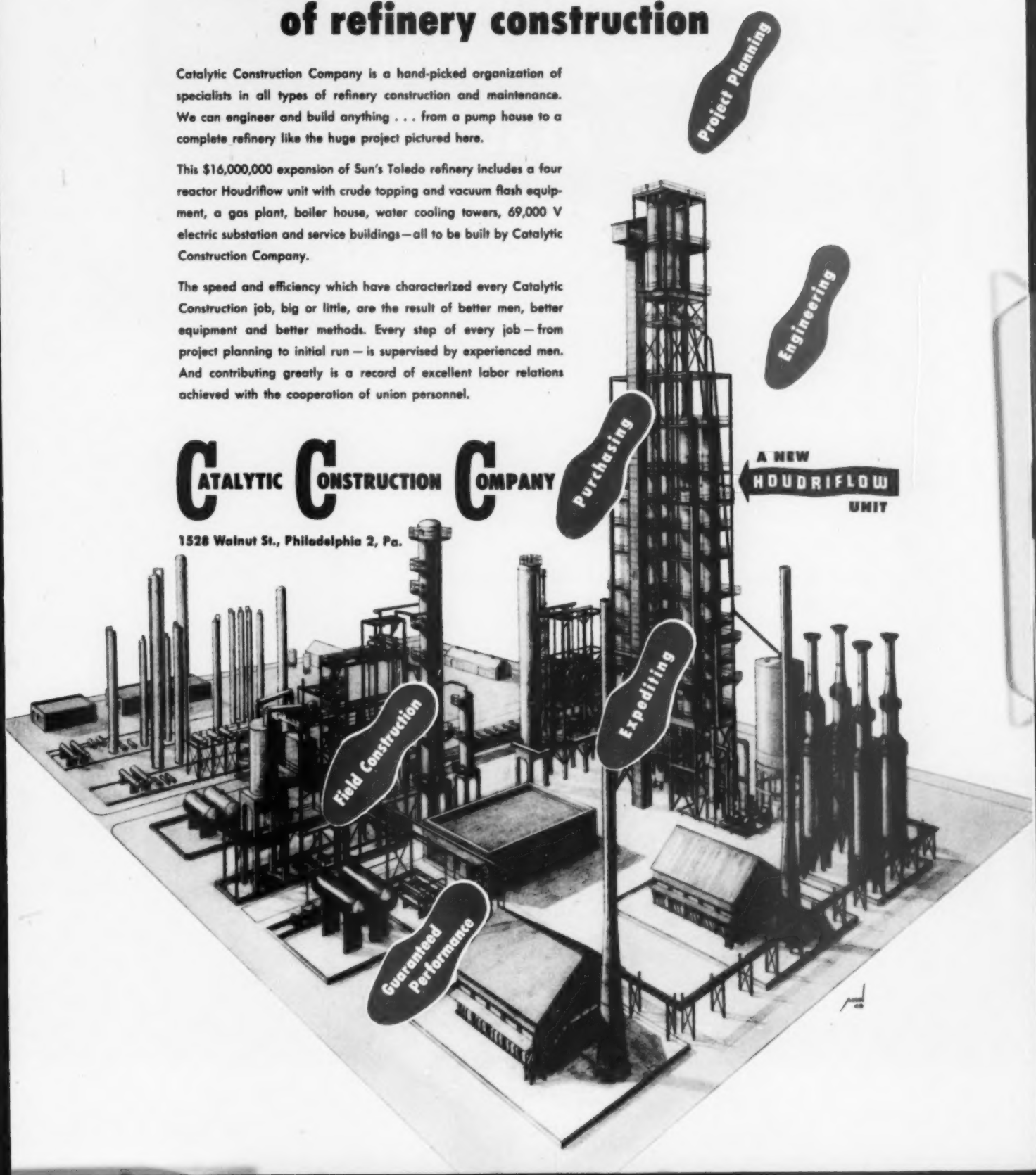
Catalytic Construction Company is a hand-picked organization of specialists in all types of refinery construction and maintenance. We can engineer and build anything . . . from a pump house to a complete refinery like the huge project pictured here.

This $16,000,000 expansion of Sun's Toledo refinery includes a four reactor Houdriflow unit with crude topping and vacuum flash equipment, a gas plant, boiler house, water cooling towers, 69,000 V electric substation and service buildings—all to be built by Catalytic Construction Company.

The speed and efficiency which have characterized every Catalytic Construction job, big or little, are the result of better men, better equipment and better methods. Every step of every job—from project planning to initial run—is supervised by experienced men. And contributing greatly is a record of excellent labor relations achieved with the cooperation of union personnel.

**CATALYTIC CONSTRUCTION COMPANY**

1528 Walnut St., Philadelphia 2, Pa.



# For any maintenance or modernization problem... HERE'S A REAL SOLUTION!

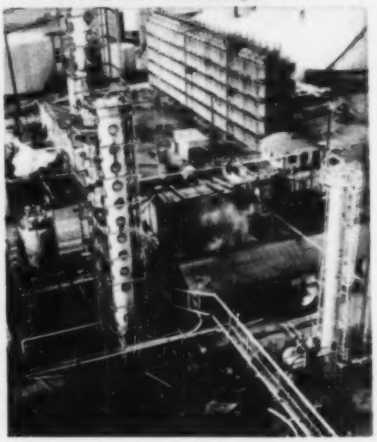
Catalytic Construction Company revamped TCC units for Ashland (above) and Continental, including modernization of kiln and reactor.

The field organization of Catalytic Construction Company includes men who have specialized for years in the design, construction and maintenance of oil refineries . . . engineers who have done all types of maintenance as well as major revamp work.

We have top-flight designers, engineers, supervisors and technicians who are familiar with every type of refinery maintenance and revamp problem from topping to Houdriflow! We can service every piece of equipment in your refinery; do a simple turnaround or a complete overhaul and modernization job.

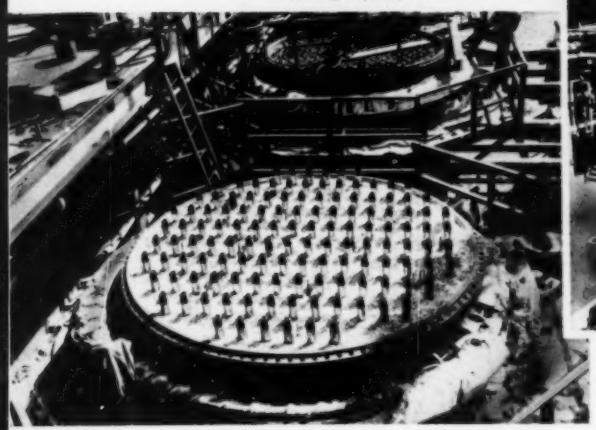
Need help in refinery maintenance? Call Catalytic for fast service!

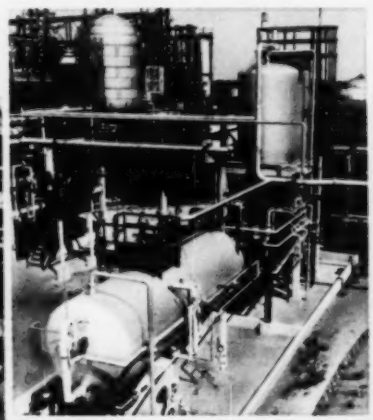
Catalytic did a general revamp of refinery equipment while building new TCC unit for Leonard Refineries, Inc., at Alma, Michigan.



**CATALYTIC CONSTRUCTION COMPANY**
**1528 WALNUT ST., PHILADELPHIA 2, PA.**

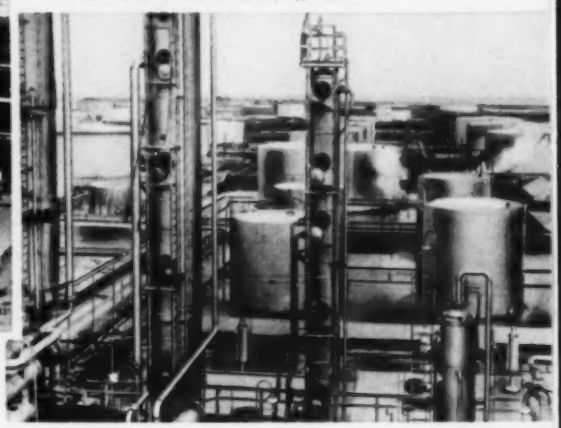
Complete modernization of Houdry fixed-bed cases at Tide Water Associated Oil refinery, Bayonne, N. J.



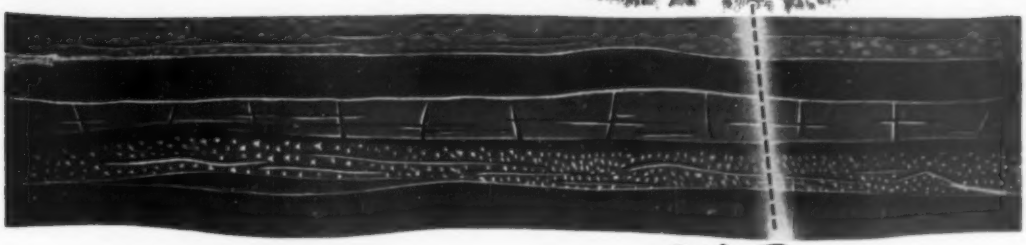


Desulphurizing unit and kerosene scrubber built by Catalytic Construction Company in Sun's Toledo refinery.

Catalytic did a complete refinery overhaul for Petrol Refineries Inc. at Texas City, Texas.



# THE SHOT That Blasted RUMOR



## Leads the way to Greater Oil Progress

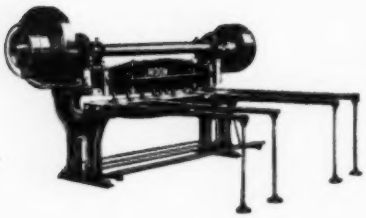
It has long been the hope of the exploration industry to obtain seismic records from shots set off above-ground. Such a hope has at last become a reality and rumors have ceased to exist.

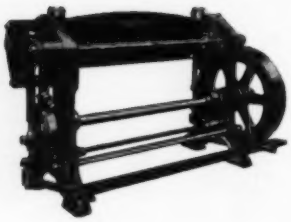
Republic Exploration has actively participated in the capacity of engineering development consultants assisting in field operations in bringing this revolutionary exploratory "looking glass" to the oil industry.

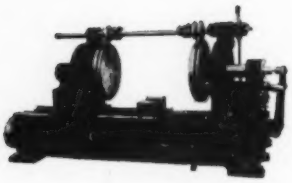
In the future as in the past Republic will expend its every effort to bring more progressive measures in the field of exploration to the oil world.

**REPUBLIC EXPLORATION COMPANY**

TULSA, OKLAHOMA







# *The team to back for*
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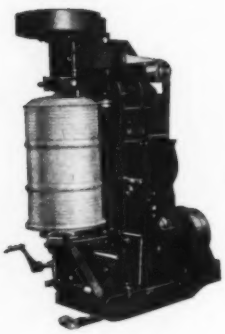
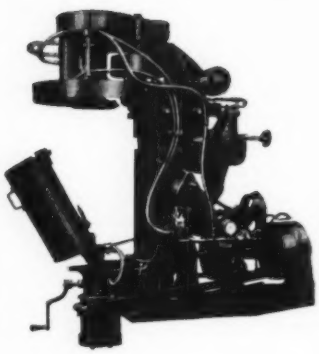
## *and all types of oil containers*



For the large producer, a complete drum making plant by MOON can end a lot of worries.

We have installed these drum-making teams in various parts of the world, and they win both at home and away. They are designed from a unique and highly specialized experience of the needs of the job, and incorporate every desirable feature.



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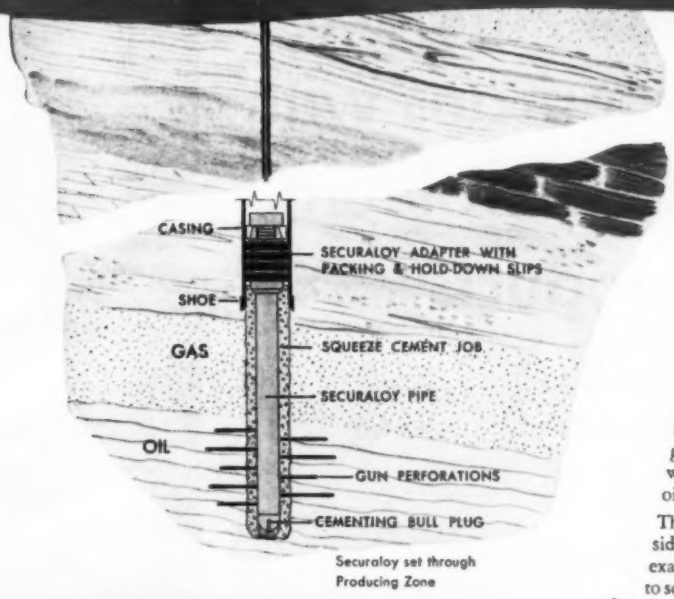
dm MB 12

LOCATION: Texas
GAS-OIL RATIO: 300 to 1
PRODUCTION: 5-6 barrels per day on pump
QUESTION: How to increase production and lower gas-oil ratio by a simple and satisfactory remedial method

# Too much gas—Too little oil?




Securaloy set through Producing Zone

When a Texas operator found his gas-oil ratio too high and production way down he determined that the positive way to correct this situation was to use Securaloy. You, too, can profit by using Securaloy to solve your gas-oil ratio problems.

This operator first tried a plastic squeeze job, but the well still made only 6 barrels per day. Then a cement squeeze job was performed, with the entire open hole left full of cement and then drilled out. This proved unsuccessful too!

Finally, the operator cemented Securaloy pipe through the gas-oil sands, as shown. Selective strata were gun perforated and acidized. The well was then completed for 80 barrels of oil per day with a 40 to 1 gas-oil ratio!

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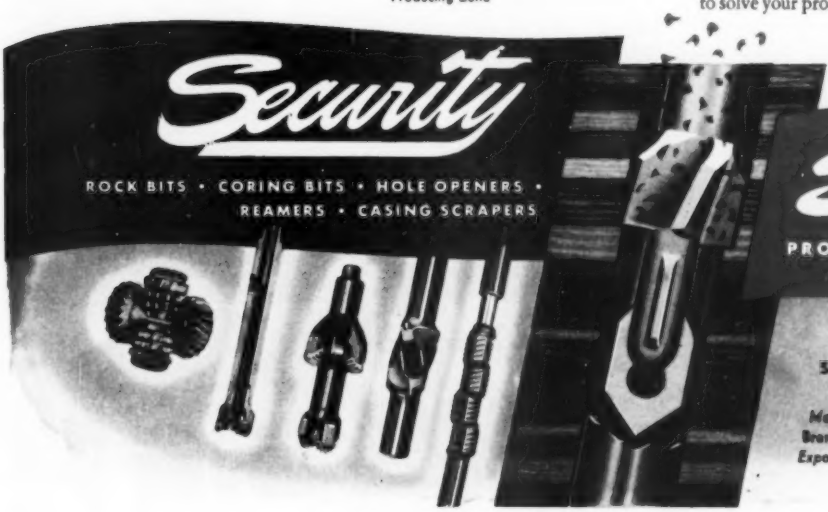

**Securaloy**

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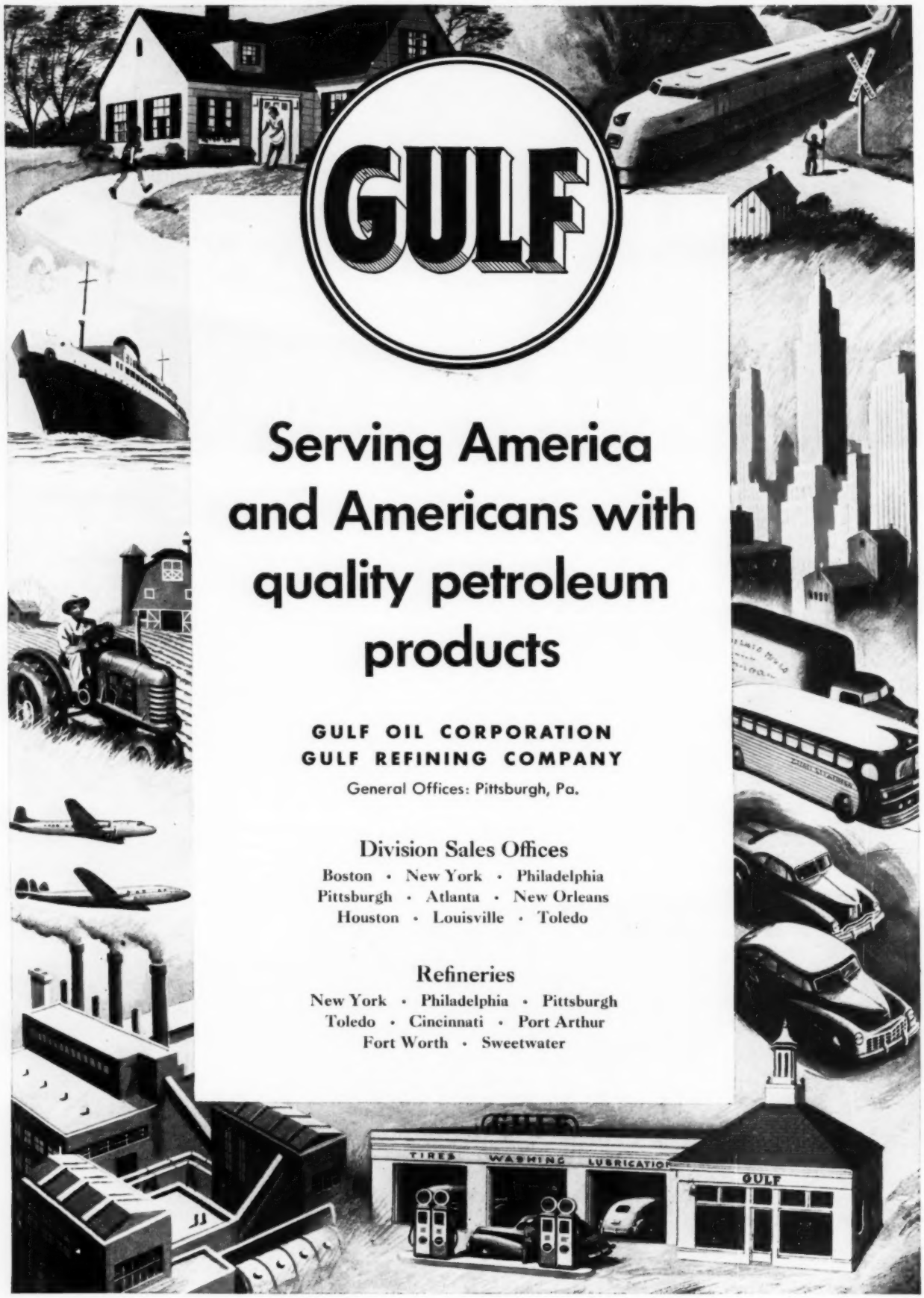


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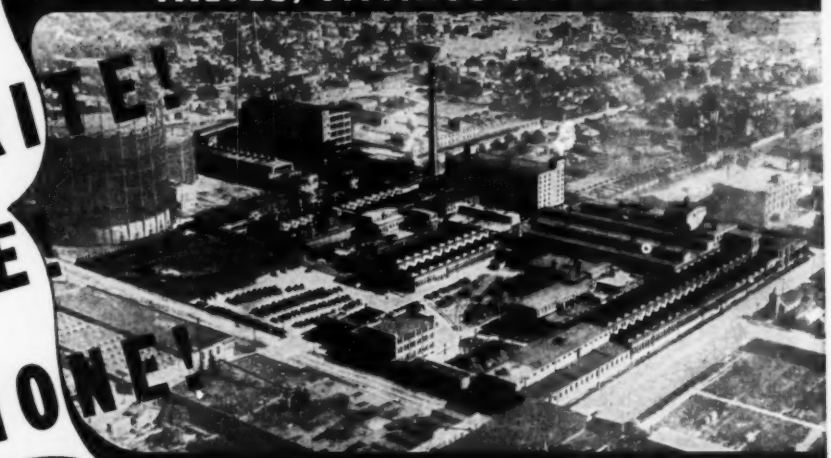

*Air View of Henry Vogt Machine Co. Plant, Louisville, Ky.*

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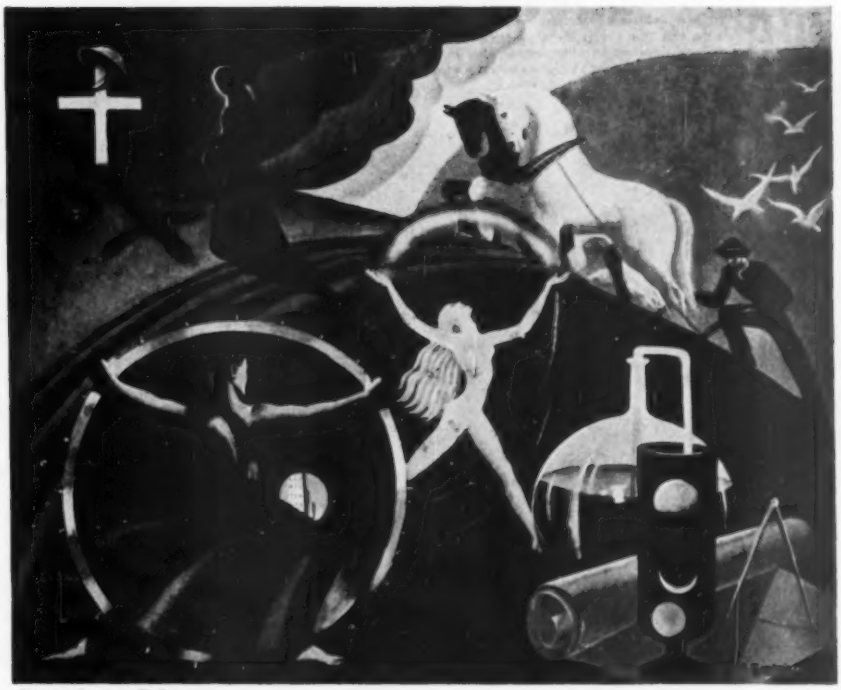

*Painting by Anna Zinkeisen*

# This Present Age . . . 3

That unit of purpose can be achieevd once the nation is inspired by a sufficiently powerful incentive is one outstanding lesson of the war. We have re-awakened to the fact that we are, first and foremost, citizens of a great nation. Our national ways, whatever their faults and shortcomings, are yet so potent as to demand in their defence all that is best of our faith, courage and even our lives. This spirit must be our urge in the difficult years of reconstruction; it will be the motive and inspiration of all our own endeavours. Granted the desire, good will and above all, unity of purpose, the many great and complicated problems can be satisfactorily resolved. No obstacles must be allowed to stand in the way of ensuring such a future and of deserving the just rewards in peace is the prerequisite of a swift accomplishment of these desirable objects, which of themselves, constitute a dynamic incentive. To keep faith with our comrades who have given their lives for democratic ideas of liberty, all our forces are being mobilised in administration, technology and production, so that by our united efforts we may contribute towards building a better world.

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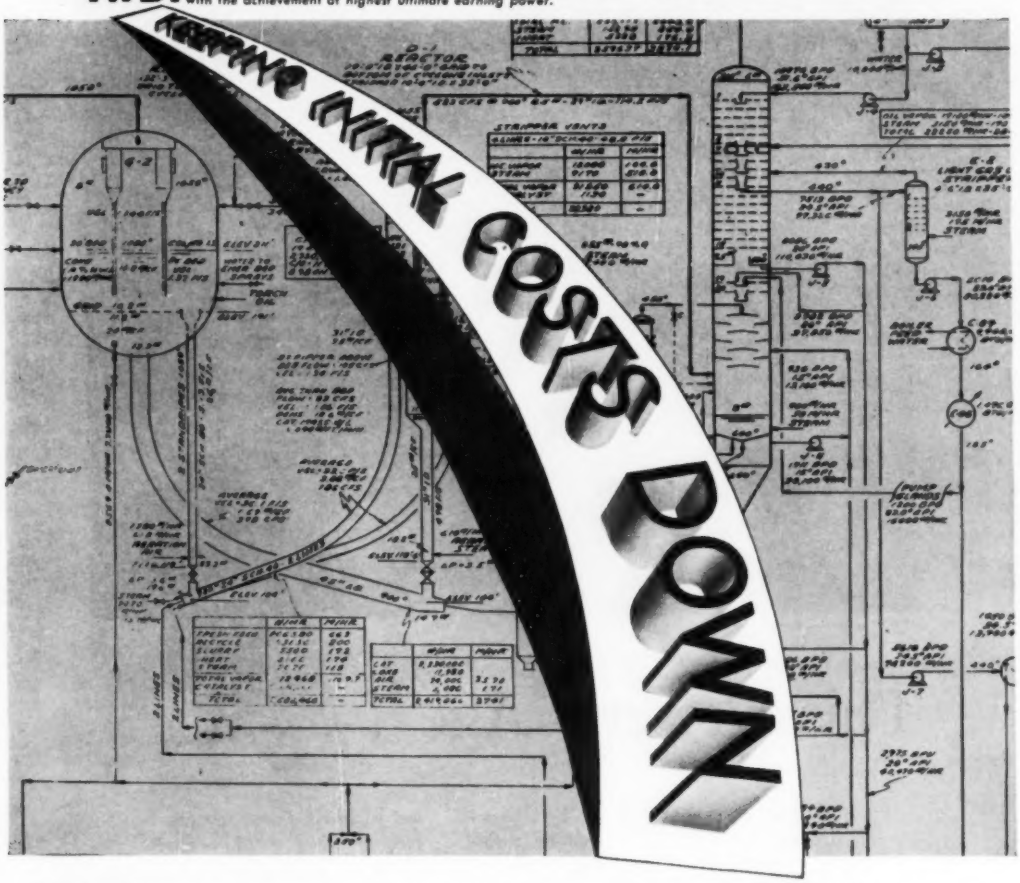
UTP 35

**N.B.** While it is axiomatic that return on investment—the *ultimate earning power* of a refinery unit when actually on stream—is the only true evaluation of competitive engineering recommendations, initial plant costs remain a major factor in refiners' decisions on plant installations. M. W. Kellogg takes specific steps to *minimize initial plant costs* consistent with the achievement of *highest ultimate earning power.*




KELLOGG starts to keep costs down at the precise point where a refinery project starts . . . in process design. For it is the quality of work in the design phase that establishes not only the ultimate earning potential of the unit but also the framework on which initial costs are predicated.

*Quality* of process engineering is, of course, dependent on the relative ability of individual engineers, their resources in data and experience, the emphasis put on process design by management . . . and, in the final analysis, on the organizational set-up within which the engineers work. Beyond the marked advantages Kellogg can show on the first three factors, its organizational set-up definitely assures *superior quality* in process engineering.

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*Superiority in process design* is only the first in the continuing series of specific steps taken by Kellogg in the direction of low initial plant costs . . . a succession of individually significant contributions that accumulate substantial savings as each project moves through Kellogg's integrated organization.

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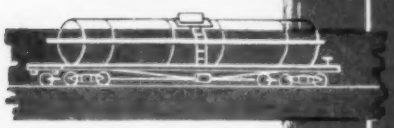

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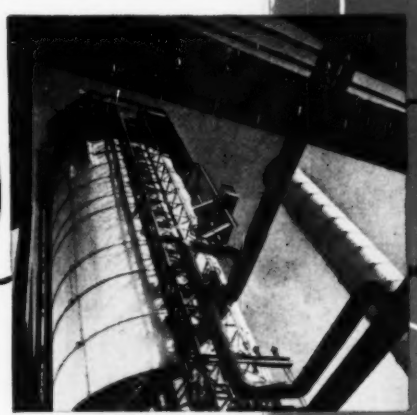

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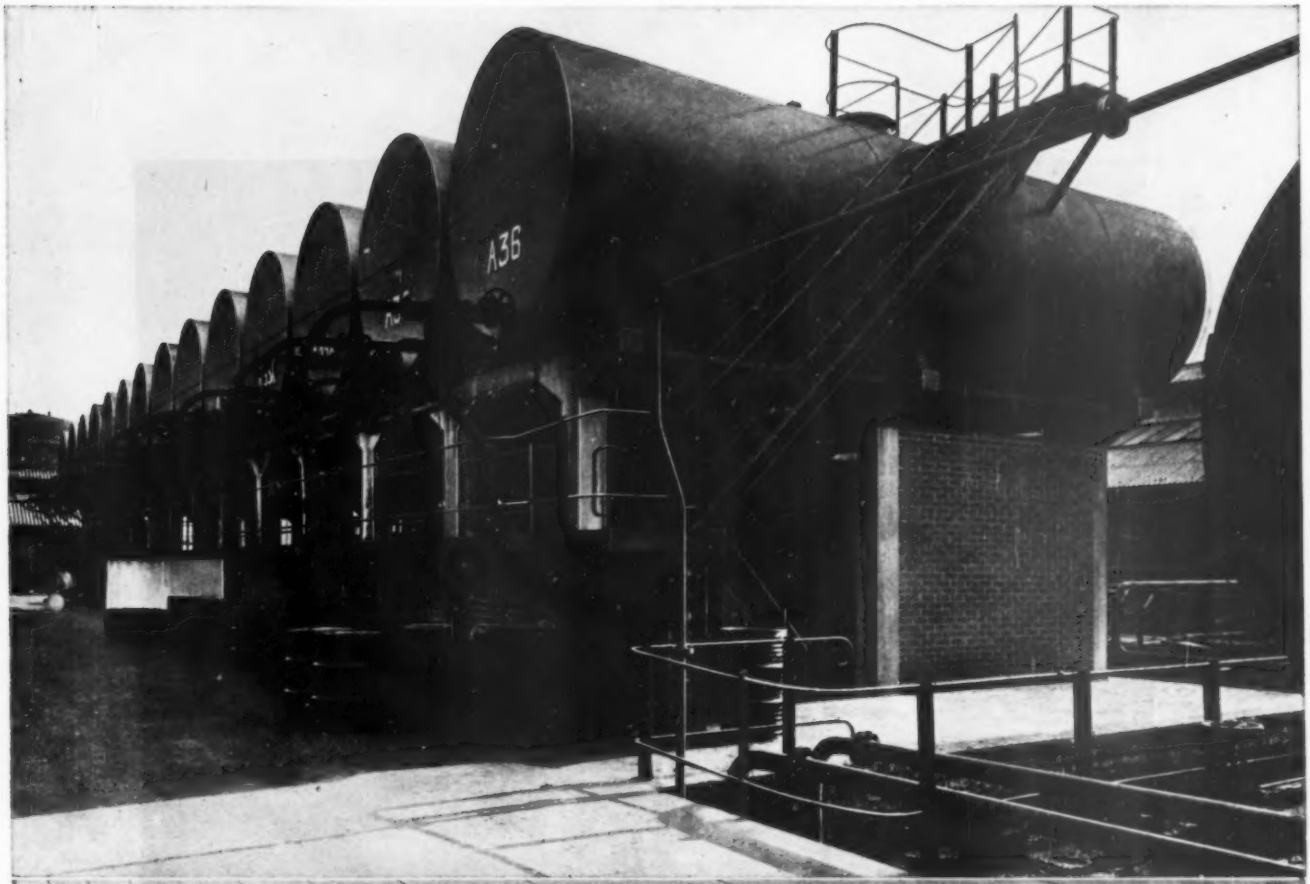


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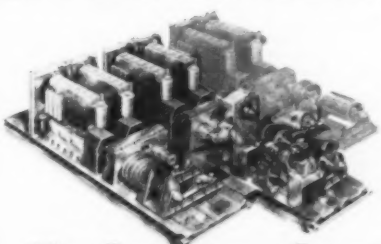

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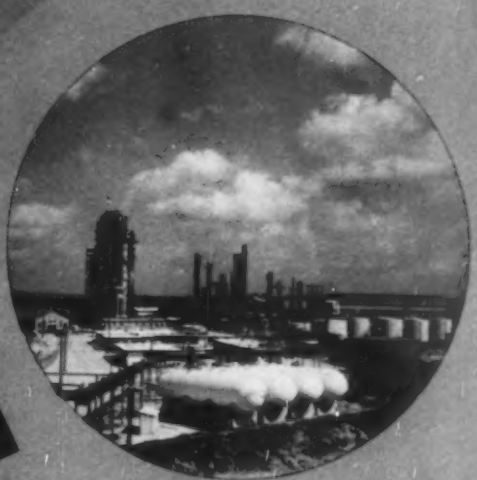

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# WORLD PETROLEUM

*Founded by Russell Palmer*

**PUBLISHED BY MONA PALMER**

THE MANAGEMENT PUBLICATION OF THE INTERNATIONAL PETROLEUM INDUSTRY



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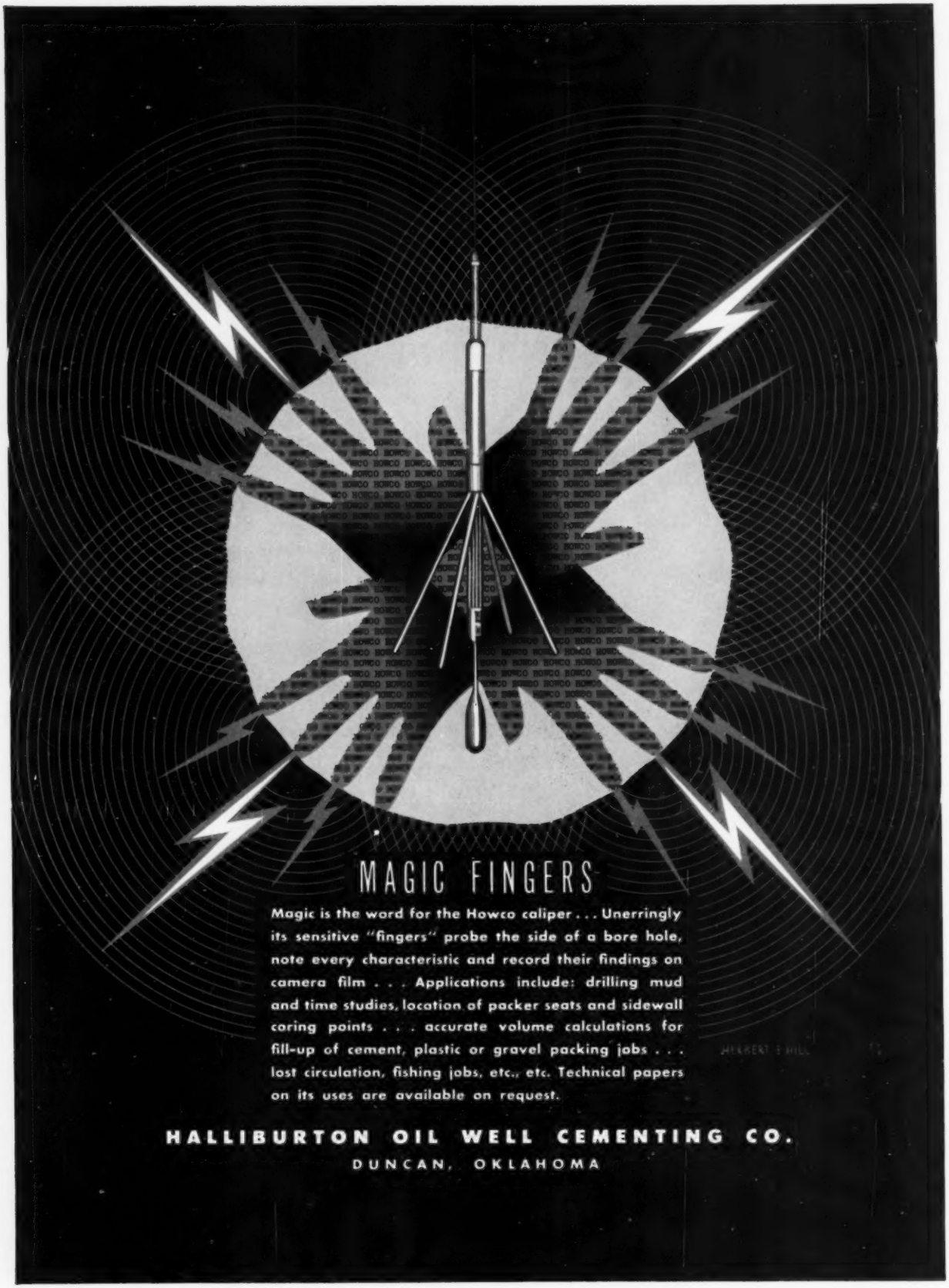
THIS MONTH'S COVER—Imperial Redwater No. 1 on the farm of Hilton Cook 40 miles northeast of Edmonton, Alberta, Canada, was the discovery well in the Redwater field which now bids fair to become of even greater importance than Leduc. Recently with only seven producers the field appeared proven over an area of some 20 square miles with potential reserves variously estimated at 80 to 160 million barrels. Photo courtesy Imperial Oil Ltd.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# EDITORIAL

## NOW COMES THE ECONOMIC COORDINATOR

WITHIN less than a single decade American industry has given two powerful demonstrations of its inherent strength and its ability to meet unusual and frightening emergencies. First was the war in which, through a miracle of production, it not only met the requirements of its own armed forces but supplied to its allies the tools of victory that brought about an early termination.

Less spectacular but scarcely less impressive has been the task accomplished in surmounting the difficulties of the postwar years, in retooling plants for peacetime production, in meeting the pent-up pressure for all kinds of commodities and in working back to a more normal relationship between supply and demand. Once freed from the restrictions imposed through war's necessity, progress has been rapid. In many lines of business it is so well advanced that the consumer no longer is a suppliant but is able to exercise his rightful privilege of choice in making his purchases.

Oil is an outstanding example. During the past year it performed a threefold service of primary importance by banishing the ogre of petroleum scarcity, meeting a ten per cent increase in demand and at the same time building up substantial stocks of all its products. This at a time when difficulties in obtaining essential equipment still persisted.

Another case in point is that of steel, a commodity that enters into almost every sphere of industrial activity and is the very foundation of expansion in the production of capital goods. The steel companies were almost swamped by the demands made upon them following the close of the war, and their first efforts to enlarge output were hampered by strikes and shortages of power, but by expenditures of more than a billion dollars on improved facilities and by steady operation at capacity during 1948 they fabricated over 88 million tons of raw steel and entered 1949 with a production exceeding eight million tons for January, or at the rate of 96 million tons for the year. Another billion dollars of outlay scheduled for the ensuing two years will raise capacity to 98 million tons.

These are two conspicuous examples of the work done by private industry in meeting the high tide of domestic demand while at the same time contributing largely to the nation's efforts toward rehabilitation of other lands. The same story is repeated in the record of practically every line of American industrial activity.

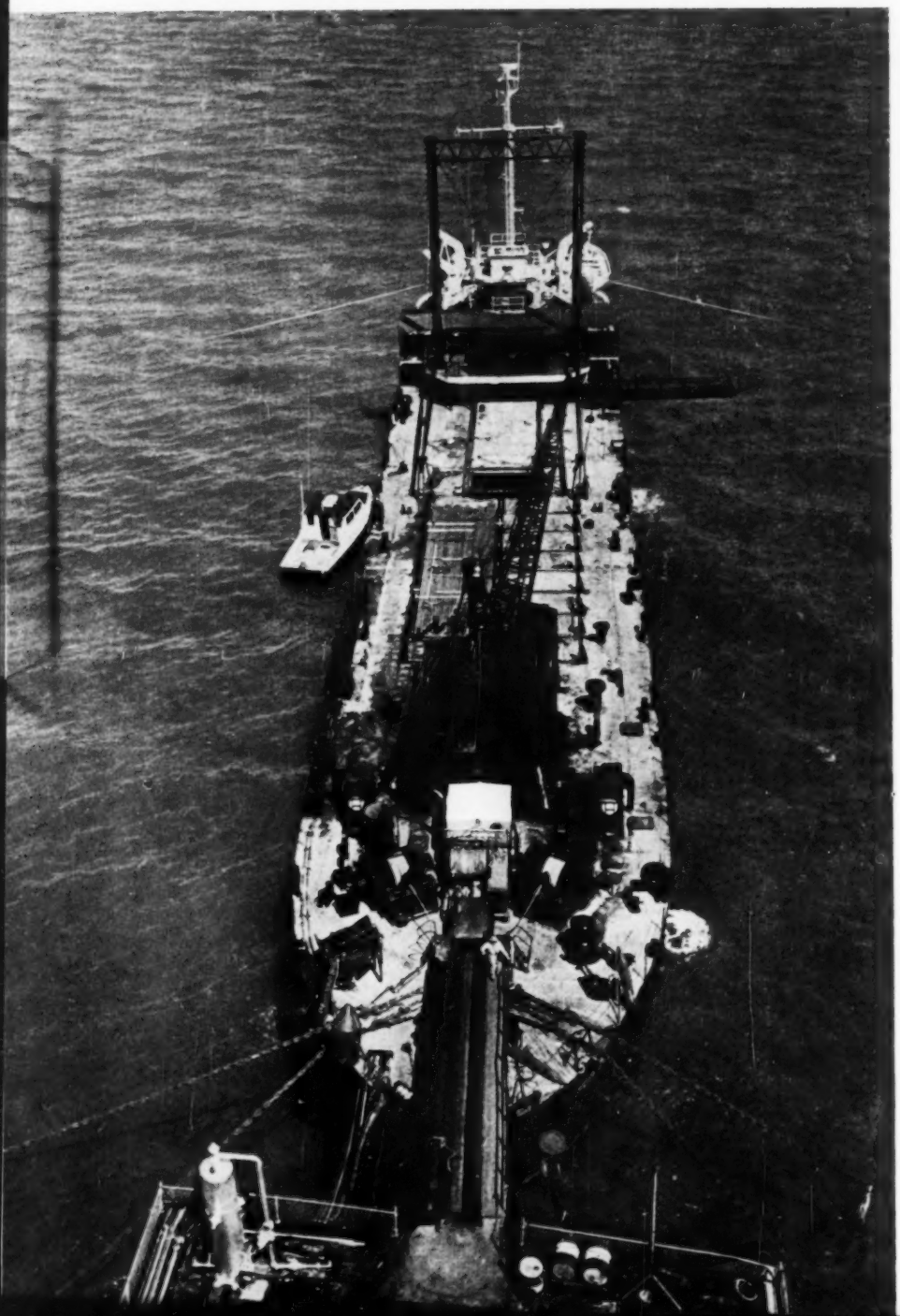
All this, however, does not satisfy the economic planners who think they see an opportunity to fix the bonds of government management upon the industrial giant which is America. Under such soothing titles as "the Welfare State" and "the Insurance State" they seek to establish the domination of a great centralized beaurocracy over every phase of corporate and individual activity. That the mirage of a planned economy has captured the administration is shown by utterances of members and unofficial advisors from the President down and is most clearly revealed in the so-called "Economic Stabilization Act of 1949", hand-fashioned by a Cabinet committee and passed on to party followers in Congress with orders to enact it into law.

This remarkable measure, which is described by its direct sponsor as designed merely to meet problems arising from critical shortages of essential materials, inadequacies of productive capacities and continuing rise in some prices, actually goes far beyond any powers ever granted to a President in a period of peace. It would permit the reimposition of discarded wartime controls, but it also would allow the Chief Executive, through the office of his Coordinator of Economy which the act establishes, to fix the price of a commodity if it "threatens to rise" above the level of December 1948, to establish priorities and allocations and to put the government into direct competition with privately owned plants in any industry where production is not expanded with satisfactory rapidity.

The economic experts who advocate the various plans all render lip service to private enterprise. They want to help business, to "guide" it and prevent it from making the mistakes which it would commit otherwise. Their method of encouragement consists in constricting profits, adding to the burden of taxation and depriving industry of the only means left to it of financing capital needs. As a further aid there is presented the prospect of arbitrary alterations in prices whenever the coordinators foresee a possible change in trend. Beyond all this looms the threat of direct competition from government-subsidized establishments.

The bill now before Congress evidently is intended to put a crowning touch on other pending projects for heavier spending and more direct interference by government in the lives and activities of citizens. It is calculated to launch the nation so well on the road to complete statism that further progress in this direction will be made easy. The interest of members of the oil industry in this attempt is that of all Americans who cherish the atmosphere of liberty in which their country has thrived for a century and a half and should lead them to exert every effort to prevent its consummation.

# MARINE PRODUCTION GAINS PLACE IN OIL INDUSTRY PICTURE



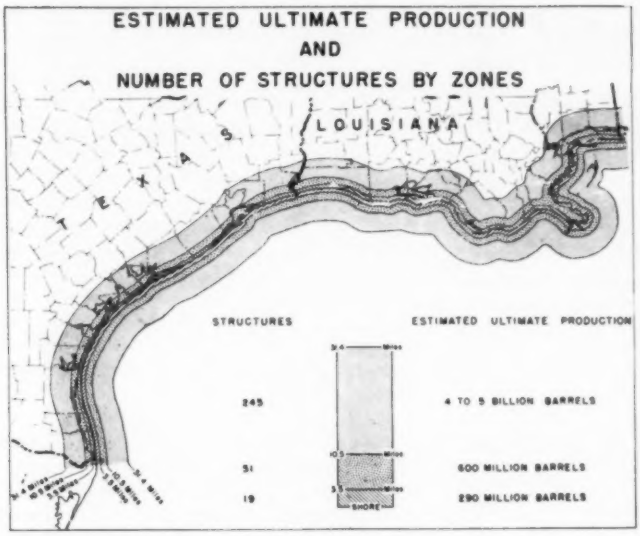
WHERE does land end and sea begin? The shore lines which mark the furthest landward reach of tidal movements are not permanent boundaries. They have shifted enormously through the ages, submerging areas once exposed and lifting others above the waters that formerly covered them, changes that still are continuing in various places. To the geologist, who concerns himself with underlying structures, the coastal regions alongshore, covered to only shallow depths, are part of the true land mass, and its real borders are where these shallow submerged sections end and drop, usually rather precipitously, to genuine ocean depths.

The extent of these underwater districts, to which the descriptive name, continental shelf, has been given and which are roughly calculated to include everything up to a depth of 100 fathoms (600 feet), vary greatly in different parts of the world. Its greatest width is believed to be in certain Arctic regions. Around the continental portion of the United States it ranges from practically zero to 100 miles or more, and its total area is computed as about 275,000 square miles, about equal in size to the State of Texas.

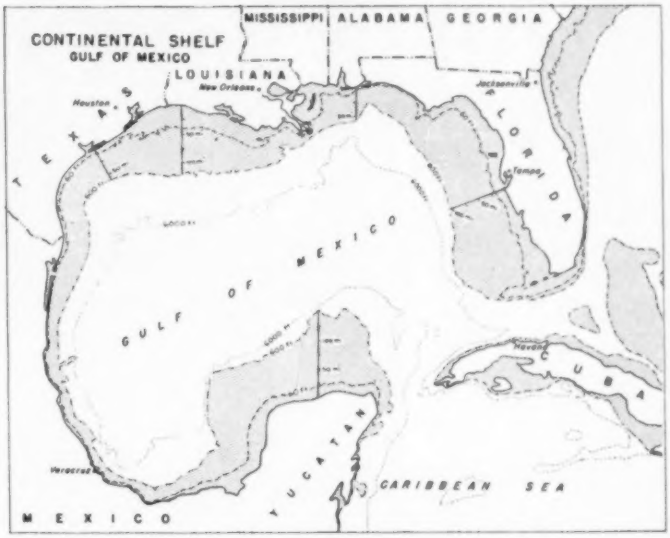
Some parts of this great marine region are more interesting than others. For example, the great coastal plain which extends across Louisiana and Texas is tilted gently southward, dropping about five feet per mile, and continuous under the waters of the Gulf at about 12 feet per mile. Some locations 20 to 30 miles out may be less than a hundred feet below the surface. The formations, consisting of continental and marine sands and shales, are the same as those that have provided prolific oil fields in land areas adjacent to the Gulf. Offshore surveys have revealed the existence of a series of salt domes similar to those on shore and have located numerous submerged "islands," the tops of which are only a short distance from the surface. Wells drilled in the open Gulf have been brought in as substantial producers.

This and other evidence that has been collected demonstrates the existence of huge potential production from these submerged lands. Enough has been learned about the extension of the Gulf coastal plain to enable geologists to calculate that at least ten billion barrels of recoverable oil can be added to the nation's reserve from this course. How great the ultimate recovery from continental shelf areas may be cannot be estimated until much more extensive surveys have been made. Very large shallow-water areas exist in other parts of the Gulf, to the westward of Florida and along the eastern coast of Mexico, the latter, of course, belonging to that country. The Gulf shelf area under the sovereignty of the United States is approximately 130,000 square miles. On the Pacific side the width is much less, except around Alaska, and the available area is placed at 18,500 square miles. Ma-

LST anchored to Humble Oil & Refining Co. rig off Grand Isle, La. Photo by Lee for Standard Oil Co. (N.J.)




Continental shelf showing area considered possible for drilling. Charts on this page courtesy Humble Oil & Refining Co.




Estimated ultimate production of coastal on and off-shore areas with number of known structures contributing.

rine drilling has been practiced in California for a number of years but has been confined to locations close inshore by wells sunk from piers extending into the ocean or by directional drilling from above the high-water mark.

While the full extent of petroliferous deposits underneath the coastal waters of the United States remains problematical, it is certain that they represent a tremendous national asset. If the ratio of productive wells is the same as in the case of land areas, it may add another 25 million barrels or the equivalent of the entire known reserve of the country. Even though it falls far short of this, it will be of very great value in enabling the nation to satisfy its growing requirements over a longer period.

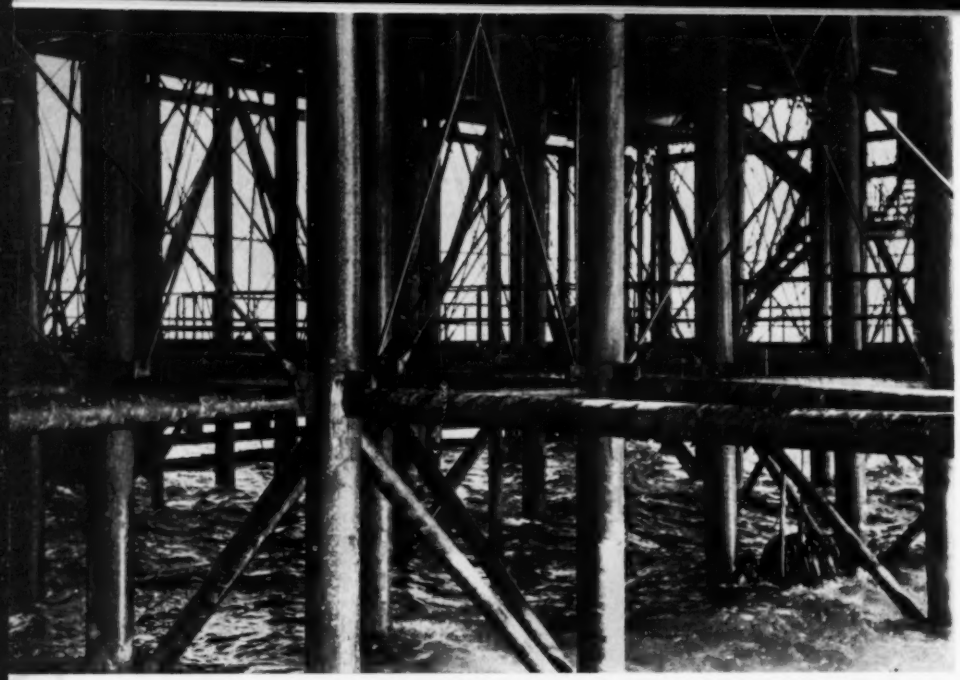
Development of the special methods and equipment needed for the finding and production of oil from submarine deposits, like all progress of the industry, has been an evolution from the ingenuity of oil men themselves. Since this kind of exploration is much more expensive than land operations, there was no inducement to indulge in it in the early days when half a continent remained to be tried out. When the search for oil extended to the bayou districts of Louisiana, a region that is neither land nor sea, but in many parts a combination of roadless jungle and seemingly endless swamps, new methods had to be devised. One of the serious problems was to provide an adequate foundation to support heavy rotary drilling rigs. An early method of meeting this requirement was to use a flat-bottomed barge which was loaded with ballast and sunk at the well site. Drilling was done through a slit or from a platform erected on the barge or from two barges laid side to side. This arrangement was satisfactory where water was only a few feet deep as it was in many places. An alternative plan was to put down a floor of wooden matting. Sometimes this was elaborated by throwing up a surrounding embankment, pumping out the water and creating an "island" from which drilling was conducted. These "islands" permitted several wells to be put down from one central point by directional drilling. Geophysical crews carried on their surveys mostly from flatboats with a draft of only a few inches. Later on a strange amphibious vehicle called a marsh buggy was introduced. It could navigate streams or penetrate swamps where nothing else could go.

Where greater depth had to be dealt with, the usual method was to sink piling over which was laid wooden flooring capable of supporting the drilling rig and all accessory equipment. The piling structure was retained when operations were extended to the deeper waters of the open Gulf, but the cost of building a foundation of this kind large enough to accommodate the heavy drilling outfit, power plant and other facilities assumed almost prohibitive proportions. One of the first of these, built by Humble Oil and Refining Company, involved an expenditure of $1,250,000. It was found that very considerable savings could be made by limiting the pile driven foundation to the size needed by the drilling rig and carrying the power plant and living quarters for the crew upon vessels of the LST type used by the Navy during the late war for landing troops and supplies. As a result of this evolution, a drilling operation located several miles offshore is served by a small fleet of auxiliary vessels which carry the power plant, provide quarters for the crews, deliver drill pipe, mud and other supplies and make removal to a new site much simpler in case a dry hole results, since only the main rig has to be dismantled for transfer to another location. No serious difficulty was encountered in stacking pipe on barges alongside the drilling platform or in making deliveries of mud and cement from such vessels. The freedom of action resulting from this arrangement has the added advantage that the servicing vessels can put off to shore or to some sheltered position in case of a threatened hurricane, thus avoiding the risk of heavy damage from such storms.

In surveying these open water areas, gravimetric and seismic methods both have been employed. Various improvements have been introduced, such as the use of a diving bell for gravimeter tests and the employment of radar in seismic exploration. By the refraction seismic method it is possible to locate areas of abnormally high velocities in the subsurface strata. By reflection shooting it is possible to construct contour maps in feet or in time and thus determine areas of abnormal uplift on subsurface beds that are often associated with structure.

As a result of geophysical surveys a large number of promising drilling sites have been located in the open waters of the Gulf and several producing wells have been brought it. One of the first attempts came to grief when the expensive drilling structure was destroyed by a hurricane. Efforts persisted, however, as more and more promisoing locations were found. One of these that led to an interesting development was an exploratory test jointly conducted in 1938 by Superior Oil Company and Pure Oil Company about a mile and half off the shore of southwestern Louisiana in what has come to be known as the Creole field. The first hole drilled went to 9,394 feet and became a producer through gun perforation from sands just below 5,000 feet. Tests showed that the substructure was heavily faulted with the oil held in fault traps. By directional drilling to penetrate these separate traps ten producing wells were put down from the one surface location.

Gradually the drilling moved further out into open waters. Some twelve miles out, south of Atchafalaya Bay, Kerr-McGee Industries in conjunction with Phillips Petroleum and Stanolind completed a well in November 1947, flowing under choke at the rate of 40 barrels per hour from sands at 1,734-50 feet. Humble's initial off-shore well at Grand Isle, 45 miles south of New Orleans and 12 miles offshore, was completed early

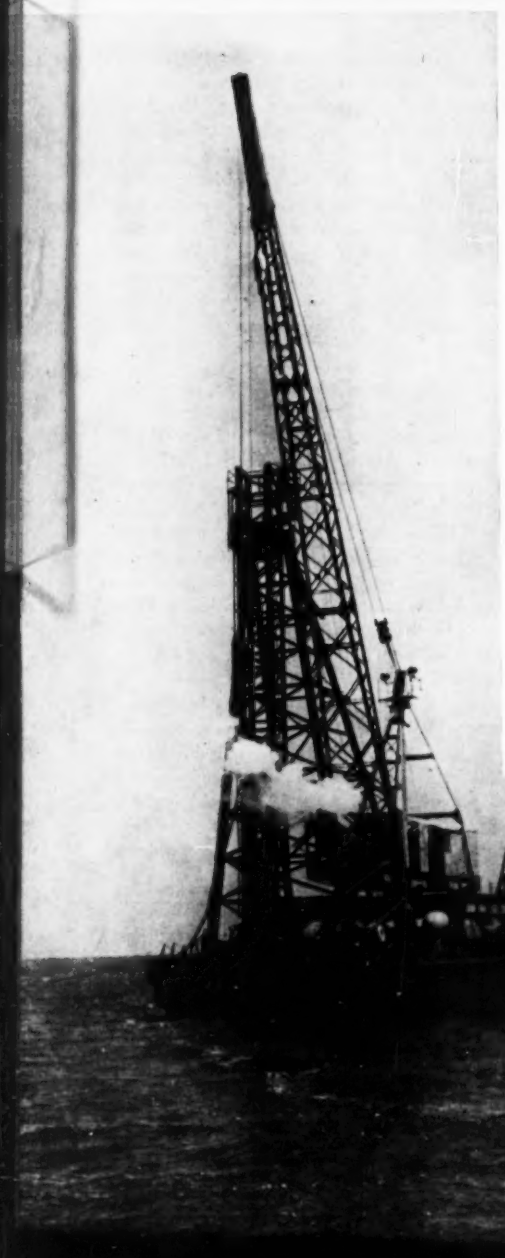


Steel understructure of Humble Oil Refining Co. Rig. No. 36.

in 1948, producing at the rate of 2,000 barrels per day from a depth of 11,000 feet with bottom pressure of 2,000 pounds.

Nearly 200 locations regarded as potentially oil bearing, the majority being salt dome structures, have been found by surveys already conducted. A large proportion are included within concessions granted to oil companies by the state authorities of Louisiana and Texas. Louisiana, by the way, lays claim to all adjoining submerged lands up to a distance of 27 marine miles from shore. Texas, in 1941, made the same claim but in 1947 amended it to include everything to the outward edge of the continental shelf. Locations now being drilled are as much as 30 miles from the shore line and in depths up to 60 feet. Drilling operations are under way by Magnolia off Marsh Island, Ship Shoal and South Pelto; by Kerr-McGee on Eugene Island; by Stanolind off Ship Shoal and Coon Point; by Humble at Grand Isle and at sea; by California at West Delta, the Main Pass of the Mississippi and off Breton Sound; and by Texas at the South Pass.

Whatever the efficiency of the methods employed, marine drilling is the most expensive of all forms of oil development. It involves deep drilling, and the cost of putting down a 15,000-foot well is estimated at more than half a million dollars exclusive of the cost of the drilling platform and its accompanying facilities. As Hines H. Baker, president of Humble Oil & Refining Company, points out, "Even though the most advanced scientific methods of exploration and drilling are employed, nine out of every ten dry land wildcats are dry, so the tremendous cost and difficulties of offshore drilling make the continental shelf operations the most hazardous in history.



Barge mounted pile driver preparing for Stanolind Oil & Gas Co. drilling operations on Louisiana State Lease 1133 seven miles off Cameron, La.

"To oil men with 20 years of development and experience in drilling in protected waters," Mr. Baker said, "moving out to the open Gulf was a natural and logical step. The greatest problem was in overcoming the sea and in protecting operations against the weather in this area, which is exposed to hurricanes.

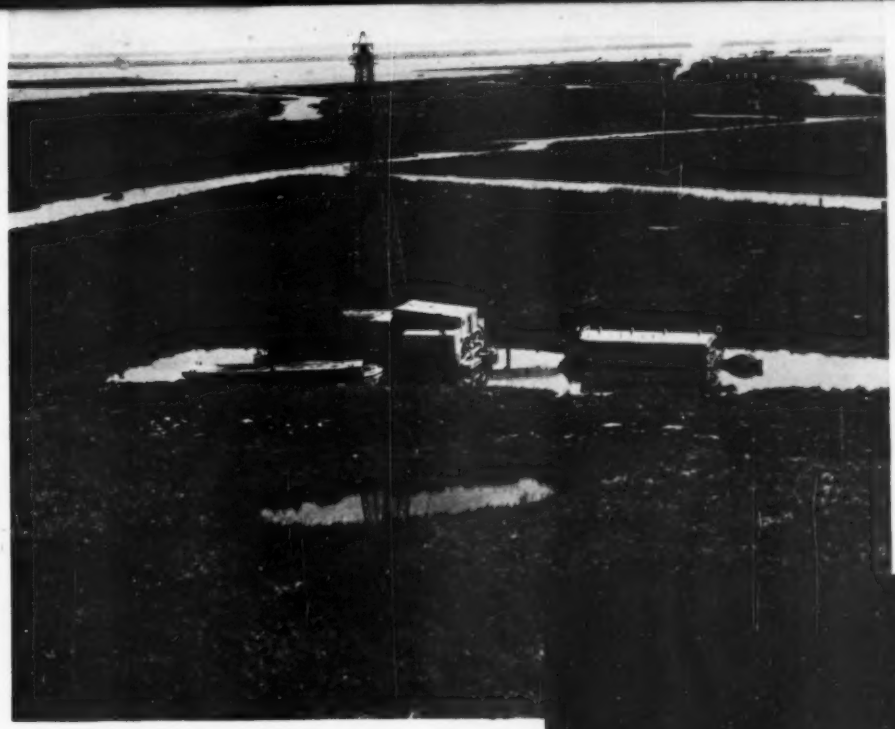
"The first well was drilled in the Gulf of Mexico in 1938 and utilized techniques developed in swampland and barge operations to open a new phase of drilling methods. The first drilling platforms were very large and held an entire rig and its supplies. To reduce this tremendous cost of offshore drilling, we built newer platforms that were held to derrick and drawworks with the bulk of the rig and supplies tied to the platform on the LST. Regardless of our efforts it still remains highly expensive to drill for oil beneath the Gulf."

Assuming that the wells drilled in submerged sections will produce at approximately the same rates at those on nearby land areas of similar structure, it is calculated that something like 30,000 wells will be needed to bring to the surface the oil estimated to exist underneath the waters of the Gulf at a cost probably of three billion dollars or more. Present investment in offshore drilling in the Gulf is figured at about $75,000,000.

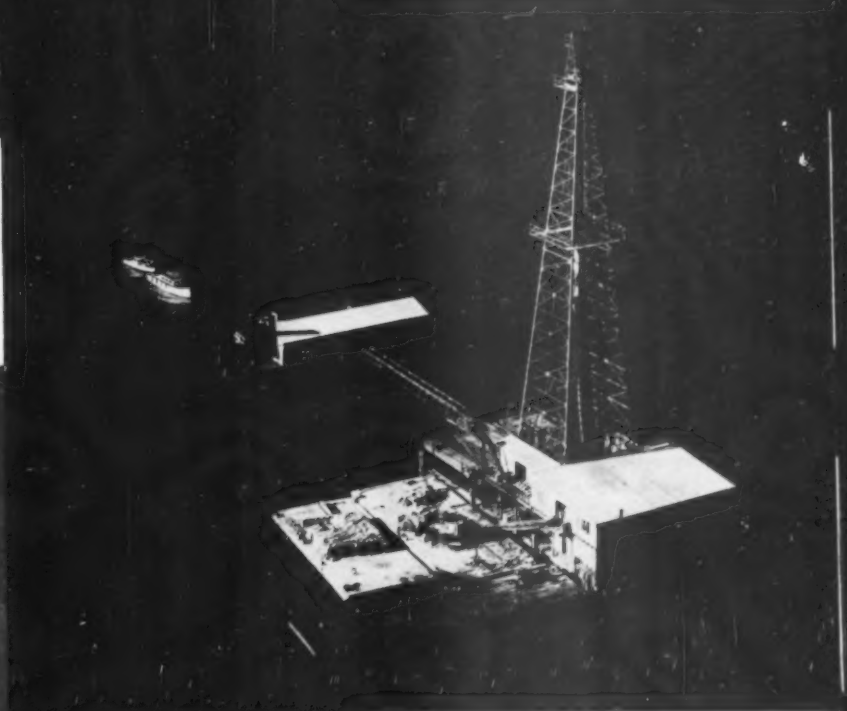
Not only is the cost exploration and drilling in submerged areas three to five times as great as on land, but the cost of production is correspondingly high. Oil produced at distances of 20 miles or more is valueless unless it can be transported to refineries on land, and no economical method of doing this has been worked out as yet. The cost of moving a barrel of oil from one of these marine locations to a refining point is about 85 cents or roundly five times as much as overland movement. Unless these conditions change, any substantial decline in the price of crude probably would quickly reduce, if it did not stop, the progress of submarine drilling.

Although offshore drilling is capable of adding greatly to the oil resources of the United States, at high cost to be sure, its future outlook is veiled in uncertainty. In 1947, in deciding a suit brought by the federal government against the State of California in which it claimed

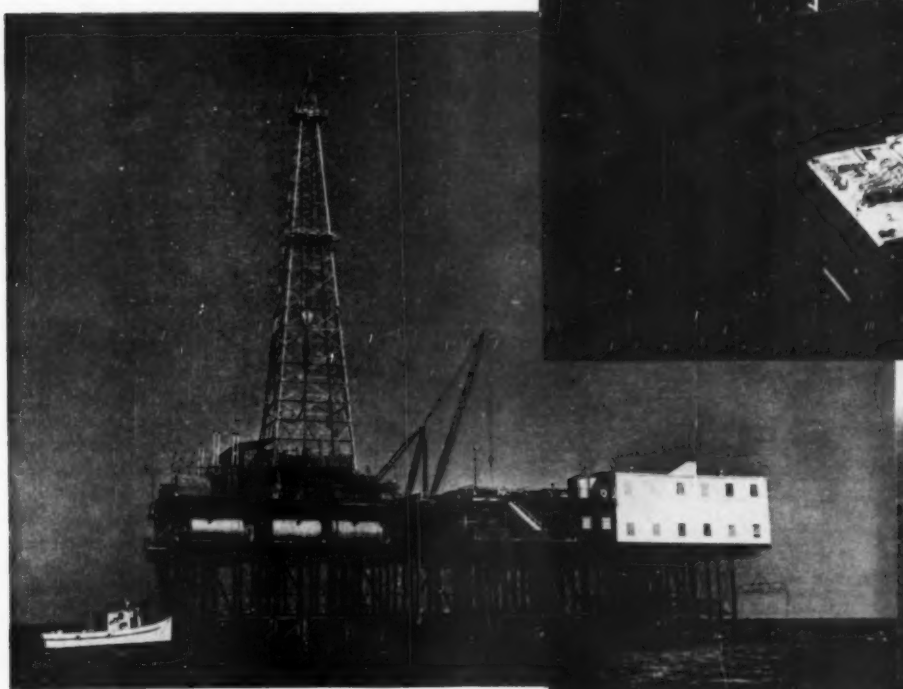
# Evolution of the Offshore Rig



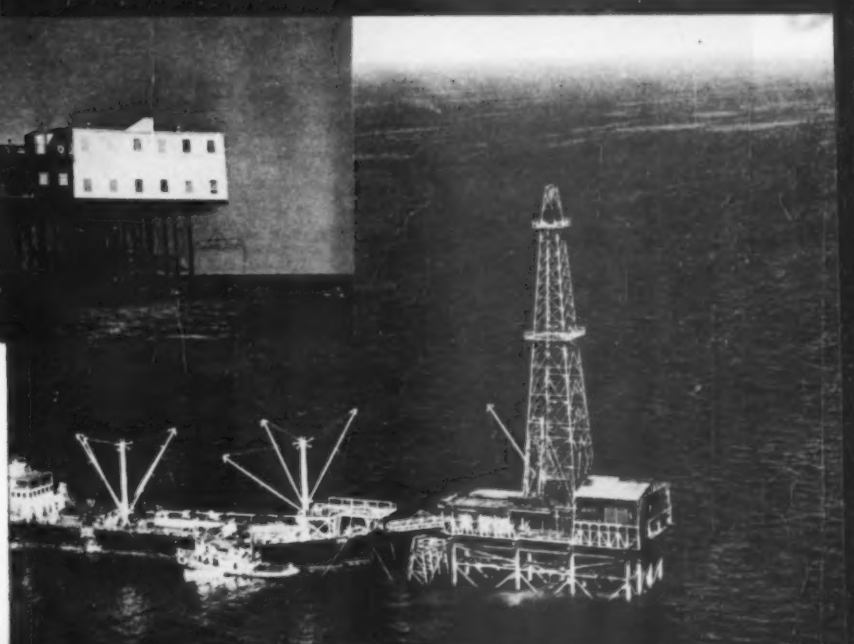
Submersible barge first used in swampy coastal areas where canals were dug to well sites and the barge sunk before drilling.



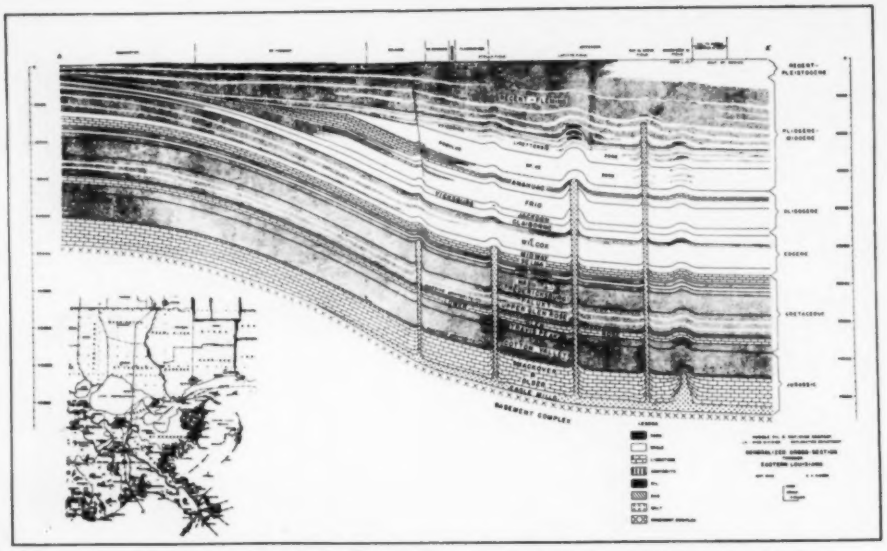
Dual structure of the type used in Galveston Bay with steam boilers on separate barge. Photo by Robert L. Browning, Texas City.



Humble Oil & Refining Co. Rig. No. 36 on which all operations were conducted from a massive platform.

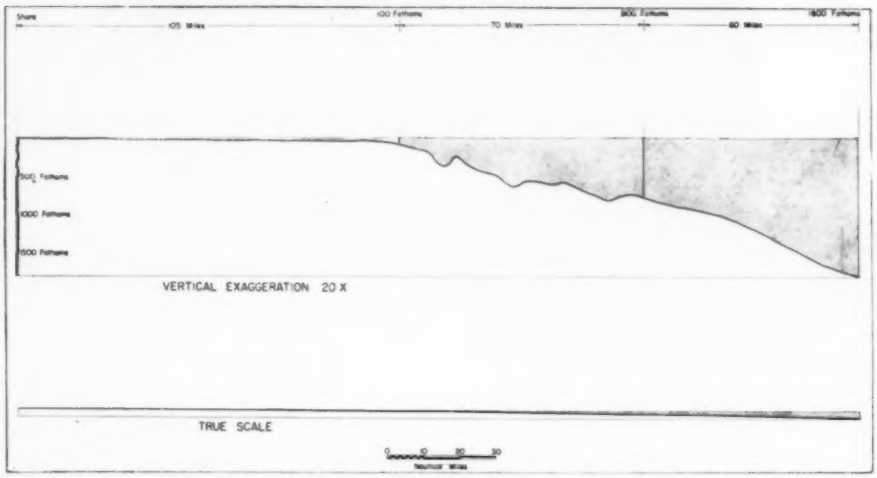


Small well platform serviced by LST tending to lower investment cost. Photograph of California Oil Co. rig off Louisiana coast by Rotkin for Standard Oil Co. (N.J.)



Generalized cross-section through eastern Louisiana showing depth of various formations both on- and off-shore. Drawings on this page courtesy Humble Oil & Refining Co.

Cross section of bottom topography in the Gulf of Mexico near Longitude 92°30'.




Gasoline recovery and cycling plant in the salt marshes west of Lafitte Village, La. in an area serviced entirely by canals. Photo by Rotkin for Standard Oil Co. (N.J.)

ownership of the submerged areas extending three miles off the coast, the so-called tidelands, the Supreme Court held that the national government had "paramount rights" in all such areas. In January last suits were filed against the states of Louisiana and Texas claiming ownership of the submerged lands contiguous to those states. These claims, if approved by the Court, which seems likely in view of the California decision, will introduce a new principle into the handling of oil development.

The contention of the federal government is being hotly contested by the states and by others who feel that establishment of the theory of "paramount rights" would open the way to the confiscation of any state property or any industry under the guise of protecting the national security. Bills have been introduced into Congress to translate into law the position of the federal administration on one hand and of the states and private interests on the other. A bitter fight is in prospect before the issue is decided.

Historically the right of the individual states to control mineral deposits within its borders including adjoining submerged lands, though frequently assailed, had always been supported in court decisions and orders up to the time of the California case. Oil has been produced from submerged lands in California since 1920. Offshore production in the Gulf goes back to 1938. Up to that time scores of court decisions and administrative orders had affirmed directly or by implication that the states and not the federal government owned the seaward areas within their borders. In practice, however, it remains true that the law is what the Supreme Court says it is, unless the Constitution or the Congress specifically says otherwise.

The primary interest of the oil industry is to continue supplying the public with its constantly growing requirements of petroleum products. The predominant opinion of members of the industry however is that the development of offshore production can best be furthered within sound limits by leaving its regulation in the hands of the states. Some of their reasons are that state rules and practices are based on long practical experience and a close study of field conditions upon which proper conservation and the requirements of maximum efficient recovery are based. Since the larger oil producers among the states derive a large portion of their income from oil, self-interest dictates that wasteful practices be eliminated and that efficient methods of operation be enforced. State regulatory bodies are much more closely in touch with local conditions than a federal bureau located in Washington can possibly be, and are less likely to be swayed by theoretical or political considerations.

Beyond these utilitarian considerations there lies, of course, the more fundamental question of the right of the federal government to take from the states rights they have exercised since the nation's foundation and that never have been assigned by them. In that attempt many see the start of a movement that may lead to complete control of industry by centralized authority.

# STEEL SUPPLY OVERTAKING DEMAND

By Joseph Huttlinger

Washington

THE president of a western steel fabricating plant strode into the huge, paneled office of Secretary of Commerce Charles W. Sawyer, plumped into a cushioned chair and talked steel.

The Secretary knows the subject. For months he has been wrestling with the problems resulting from a tight supply of steel products. How is your supply situation? he asked. The Westerner replied: "Until a few months ago, it was tight. But now, what I need is orders."

This may be an exceptional incident, but talk of this nature is being heard more and more and reflects the steady easing of the situation. The change is of particular significance to the oil industry at home and abroad. It means more oil country goods will be available when and where needed. It means more plate and sheet steel, more rods and other steel products such as containers for the oil industry.

In line pipe, the situation remains relatively tight, a condition that promises to continue for another year. This applies particularly to large diameter pipe for which great tonnages are required for long distance gas lines and, to a lesser extent, by the oil industry. Much of the future output is covered by contracts, some of them running as far as 1953. But to ease the pressures for pipe supplies, oil industry leaders are laying plans for equitable division of available supplies and to take care of "distress" cases.

The picture on steel plate is not entirely clear because of uncertainty as to what the military is going to ask in the way of storage facilities for oil. If it should submit a large storage program and get it adopted, it might test the steel industry's ability to supply this product. To this extent the plate steel picture is more problematical than the sheet steel picture.

Best-informed government officials seem to think the steel shortage is ending. This is by no means unanimous, however. In an administration committed to a political attack on inflation and shortages, optimism in supply runs counter to the "party line." Thus there are divided opinions in government circles as well as varying views among oil men.

Here's what Secretary of Commerce Sawyer has to say: "Months ago we estimated a shortage in oil country goods. The increase in production has been so marked that the demand was practically met. We have been advised by the American Iron and Steel Institute that production is increasing at a rate to meet a prospective demand for 42,000 wells in 1949. This is higher than the 1948 drillings. It now appears there may be a surplus."

Here are some of the indications bolstering the Secretary's words.

The scrap shortage, while talked of from time to time, is no longer acute. Scrap prices have fallen $10 a ton, and the advisory committee on steel scrap is at least temporarily inactive. The gray market for steel has practically disappeared, say steel brokers. Even conversion agreements are passing out of the picture.

Clifford A. Hahn of the Commerce Department's Office of Industry Cooperation.

Foreign demand for steel products is relaxing. It had been so great that the government imposed an export control law to limit the drain on domestic supplies. But now the Commerce Department finds that many countries are not taking up all the allocations given them. One reason may be rising European steel production.

As George Bell of the Office of International Trade said, "There's a law even more rigid than the export controls coming into effect, and that is one based on dollars. Many of the foreign governments haven't the dollars to buy the steel." Nevertheless, he asked Congress to extend the export control law, which applies to other "scarce" products (about 400 at this writing), for two years. He acted, presumably, on orders from the White House. We need controls "just in case," Mr. Bell said.

The domestic demand is easing. A sign of this lies in recent operations under the Voluntary Allocations Agreements act, passed by Congress 18 months ago in a frantic step to avert the threat of mandatory price and distribution controls. Granted immunity from the anti-trust laws under the act, steel industry leaders got together and agreed to furnish definite amounts of steel to 16 "essential" projects. By far the largest was freight car production, where the amount was 250,000 tons monthly. The present status is that the railroads are failing to use all this steel by a wide margin.

"The problem is not getting the steel, but getting orders from the railroads," said Secretary Sawyer. "Recently there has been a marked decline in orders. There is available more steel than they want."

A similar situation is noted with respect to barges for the petroleum industry. In this, the steel industry underwrote an agreement to supply 20,000 tons monthly for construction and repair. Now the orders for barges are falling below the steel quotas, officials say.

In other programs under the act, the steel men guaranteed 16,530 tons monthly for tank and oil field production equipment and 40,530 tons for oil tankers. A program for oil country goods and line pipe has been a hotly debated subject for the year and a half of the program. Now that the voluntary agreements program has been extended through September of this year, more debate may be expected.

Interior Secretary J. A. Krug has been urging the steel industry to guarantee steel for these tubular programs. Steel executives have refused. The oil country goods output this year will be "at or near demand," they said. "In tube goods, we will keep the mills operating at capacity, and that is the best we can do." The Commerce Department agrees this is a reasonable stand.

Interior disagrees, however. C. Girard Davidson, assistant secretary of the Interior, and Secretary Krug are still fighting for a firm agreement. As Secretary Krug sees it: "The steel industry has made substantial progress in providing a greater quantity of steel for this important industry. I am a little disappointed that some of the oil industry representatives are satisfied with what has been done, and don't think it necessary to push further for a firm agreement. I think that is a mistake.

"As I have told the steel industry representatives many times, 'if you are willing to say that the necessary will be done, you should be willing to have it firmed up so we know it is going to be done.' I hope we wil get the support of the oil industry people who have been working with us to achieve that purpose."

That support, however, is lagging. Oil men, under the leadership of the National Petroleum Council's steel requirements committee, had asked for tubular goods guarantees from the steel industry. Apparently that is ended now. At the last meeting of the NPC, oil men discussed the situation. They refused to insist upon a guarantee of tubular goods supply. Instead they decided to restudy the steel needs of the oil industry. There was a feeling that steel supply might be adequate.

A current statistical picture comes from Clifford A. Hahn of the Commerce Department's Office of Industry Corporation. A recent steel industry—Commerce Department survey, he said, discovered that there'll be enough or nearly enough oil country goods this year, at least 1,803,000 tons. Uncertainties are the number of wells to be drilled and the amount of steel required for each. On line pipe the 1949 production promises to show a surprising increase of 2,553,517 tons. The total, while short of demands, will be far higher than even steel industry men had thought.

This is how Secretary Krug sees the 1949 objectives of the Interior Department compared with estimates of 1948 performance.

| | Year 1948 Current Est. | Year 1949 Current Est. |
|---|---|---|
| Well Drilled, domestic | 39,000 | 43,000 |
| Footage drilled, domestic | 135,000,000 | 150,000,000 |
| Oil Country Goods Domestic-tons/yr. | 1,512,000 | 1,680,000 |
| Foreign-tons/yr.* | 212,000 | 211,000 |
| Total Oil Country Goods | 1,724,000 | 1,891,000 |

* Foreign-U. S. owned

Based on this Commerce and the steel products advisory committee made a checkup of the situation in January, including non-integrated mills, and turned up the following forecast for 1949.

| Oil Country Goods Requirements | 1948 Performance | 1949 Est. Performance | Interior Dept. Obj. |
|---|---|---|---|
| Oil Country Goods Produced, tons/yr. | 1,674,876 | 1,803,103 | 1,891,000 |
| Well drilled | 39,121 | 42,128 | 43,000 |
| Ratio tons/no. wells | 42.8 | 42.8 | 44.0 |

"It would appear from the above figures," Mr. Hahn commented, "that there will be a deficit of only 872 wells or 87,897 tons of oil country goods in meeting requirements of the oil and gas industry as presented by Secretary Krug. This apparent deficiency in tubular goods results in part from using the estimated ratio of tons of oil country goods to number of wells to be drilled (44.0) which apparently was used in the Interior Department presentation. Were the actual experience of 1948 (42.8) used in the computation, the deficiency would be only 37,297 tons.

"As to the possible ultimate capacity of all integrated and non-integrated mills, it would appear from the survey that 1,845,101 tons of oil country goods should be produced with existing facilities under optimum conditions. This is an increase of 42,098 tons which would offset the deficiency indicated above. Whether or not the ultimate capacity can be attained by all mills is a matter of some speculation in view of those material and labor contingencies which are ever imminent in all industries. It is significant, of course, that the anticipated composite production figure for 1949 is within two percent of the total capacity of the industry."

Secretary Krug's presentation covering line pipe was confined to a projection of the original estimates of requirements by the steel committee of the National Petroleum Council for the period July 1, 1948 to June 30, 1949, to an annual basis. Such production figures were.

| Line Pipe Tons/Yr. | Requirements on Annual Basis | Deliveries on Annual Basis |
|---|---|---|
| Domestic estimates | 3,337,000 | 1,700,000 |
| Foreign estimates* | 423,000 | 150,000 |
| Total estimates | 3,760,000 | 1,850,000 |

* U. S. owned

These figures are best considered in light of the past annual production of pipe. The record shows:

| | Line Pipe Production (Tons) | | |
|---|---|---|---|
| 1936 | 620,000 | 1942 | 1,049,000 |
| 1937 | 741,000 | 1943 | 1,127,000 |
| 1938 | 289,000 | 1944 | 986,000 |
| 1939 | 641,000 | 1945 | 845,000 |
| 1940 | 796,800 | 1946 | 974,000 |
| 1941 | 1,222,000 | 1947 | 1,476,000 |

Mr. Hahn commented: "From the above it is computed that in the four prewar years the average yearly usage of the petroleum and other industries requiring line pipe was about 737,000 tons. During the war years the average increased to about 1,000,000 tons—largely as a result of pipeline projects highly essential to the war effort.

"Now it would appear that the oil and gas industry alone would require considerably more than three times the high average of the war period. This is probably an exaggerated impression, since timing is an important factor and some line pipe projects are of pretentious proportions and require an appreciable period for construction.

"The most essential facts as to the line pipe situation determined as a result of OIC's survey of the pipe producing mills—both integrated and non-integrated—are:

Estimated 1948 production 2,221,084 tons
Estimated 1949 production 2,553,517 tons
Estimated maximum production 2,675,617 tons"

Mr. Hahn went on: "The above figures may be surprising to many well-informed persons including those in the steel industry. It had been the consensus that the peak production for 1948 would be about 1,725,000 tons, which is a substantial increase over the peak production of the year preceding. The recent figures show that the pipe producing mills have increased production in 1948 slightly more than 200 percent over the prewar averages. The anticipated 1949 production—if attained—will represent a 246 percent increase over that base. This estimate depends, of course, upon continuing stabilized labor and material conditions in the industry and no further appreciable diversions of heavy sheets and light plates.

"As to the possible attainment of the ultimate in capacity of the existing facilities for producing line pipe—2,675,617 tons—which represents an increase of 122,100 tons over the anticipated 1949 maximum production, this is a problem for the steel producing industry to resolve. Part of it may be attained through the diversion of more steel to pipe producing mills, but one must recognize the apparent fallacy of hoping for the total possible increase. The added production of necessity would have to come in large part from mills not now equipped to produce long lengths and other standard characteristics required in the oil and gas industry."

The Hahn figures, including non-integrated companies, are higher than American Iron and Steel Institute figures, which do not include full data on non-integrated mills.

Secretary Sawyer says the latest check-up indicates a possible surplus of oil country goods. Secretary Krug disagrees. The NPC's steel requirements committee believes the prospect so favorable that it refused to insist upon a voluntary agreement from the steel industry on tubular goods. The chairman of that committee, Russell B. Brown, is not satisfied with the steel outlook but maintains that the export of steel products contains a threat to domestic oil producers.

"If we are to produce the oil we need in this country," said Mr. Brown, "we shall need more steel for oil country goods than we got last year. The only thing that could change this picture is a depressed market for oil resulting from imports. In other words, if we don't need more steel, it will be because imports are displacing domestic oil.

"Our association of producers throughout the United States (Independent Petroleum Association of America) has been objecting to unnecessary exports of steel and large imports of oil. We have maintained that the domestic industry, if given the steel, would get out the oil.

"Now we are sending steel abroad and bringing back the product of that steel in the form of oil. If we keep that up, we could fix it so we would need very little steel for the domestic industry. If we presume we are going to satisfy our requirements here according to the way we have been counting on, we are going to need all the casing we can get, all the 1.8 million tons the steel people say they can make."

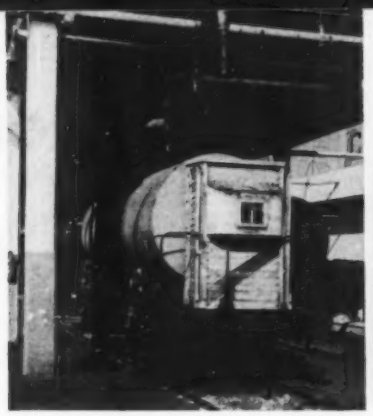
In a summary of the situation prepared for WORLD PETROLEUM, Mr. Hahn said:

"The overall situation as to steel for the oil and gas industries is indeed promising. Much still depends upon the general business situation. Any decrease in take by other industries will naturally ease the situation as to the continuing demands of the petroleum industry. This is especially true with respect to sheets and plate.

"Since the war the real problem in steel so far

*(Continued on page 104)*

# Italy Plans Increased Production And Distributing Facilities



Tank car loading at Vado Ligure for Switzerland.

Tanks in the Vado Ligure marine terminal.

THE year 1948 has been one of substantial progress in the Italian oil industry. Consumption of petroleum products increased, exploration and drilling have been renewed, refinery reconstruction is well advanced and facilities for storage and distribution have been installed.

These activities have been encouraged by various influences, including the return of the industry to private hands following liquidation of the Italian Petroleum Board and the improvement in the general economy. Industrial progress is expected to continue and to attain still larger dimensions in 1949 when the effect of the ECA program will be more fully in evidence.

Survey work and exploratory drilling have been going forward in the Po Valley and in various other areas. According to report, AGIP (Azienda Generale Italiana Petroli) has made promising locations between Lodi, Parma and Crema. New wells have been put into operation at Ripi and at Tramutola, while S. A. Idrocarburi Nazionali has increased its capital to extend its development work in the Pietramala district near Florence. It is reported also that the McMillan Petroleum Company, which holds a concession in Sicily, will carry out test drilling to a greater depth, following the suggestion of Prof. Fabiani of the Regional Mining Board who believes that oil might be found at a depth of possibly 10,000 feet.

Additional gas wells have been drilled in the Po region resulting in plans for additional pipelines to handle the increased output. One of these is to extend from Adria to Ravigo, Bologna and Milan with a branch to Varese and another to Como, after crossing the methane gas district of Cavriaga, west of Milan. This Cavriaga district is being connected to Bergamo through a line under construction for AGIP. Another projected line will extend from the Po Valley to Genoa. Dr. Kotlenko, chairman of Societe Italo Americano del Metano, calculates that these lines will make available to the industrial cities of northern Italy 1,500,000 cubic meters of methane daily.

One serious handicap to field developments in Italy is the lack of modern drilling machinery and the necessity of depending upon antiquated and inefficient rigs. There is great need for modern equipment capable of drilling to greater depths, and this situation has led to the recommendation that ERP or government funds be advanced for the purchase of up-to-date equipment on the ground that it will lead to larger production and decrease expenditure for imports.

One of the urgent needs of Italy has been the provision of greater storage space in connection with refineries and particularly at coastal points. Nearly all refinery tank farms and storage depots were destroyed during the war, and these are now being replaced. Italian oil men and officials maintain, moreover, that Italy offers special advantages as a distributing center to central and western Europe and as a strategic location for plants to refine Middle East crude for European markets or for the transshipment of imported products to such markets. This calls for the location of large coastal stations at deep water ports, accommodating the largest ocean-going tankers, and may lead to a shifting of location for some of the refineries projected for construction. For example, it has been suggested that a new refinery be built at Taranto where four $T_2$ tankers can berth at once along the quay.

One of the newest and most completely equipped bulk distributing stations is that of the Standard-Italo—Americana del Petrolio at Vado Ligure (Savona), which with its capacity of 475,000 barrels, is the most important of the eight coastal stations of the Standard company in Italy and Trieste. The station is situated at a junction through which 13,000 railway tank cars move yearly. It is connected to the sea by five miles of pipe and extends along a pier to water of sufficient depth to accommodate the largest ocean tankers. Cargo is delivered by the ship's pumping facilities, but an emergency pumping station is situated on the pier and has an unloading capacity of 400,000 liters per hour. The pipelines lead to 26 steel tanks with a capacity of about 425,000 barrels and a second group of 20 tanks with a capacity of 50,000 barrels for lubricating oils. The station will handle an average monthly traffic of 30,000 tons, one-third of which will go to Switzerland.

It is announced also that the Royal Dutch-Shell Group will utilize west Italian ports for the transshipment of oil products to central Europe and that Anglo-Iranian, through its agreement with AGIP, will install similar facilities at Venice for the movement of oil industry products to Austria.

In connection with the development of the transit of oil through Italian ports, Italian shipowners are considering the possibility of increasing the country's tanker fleet from the present 750,000 tons deadweight to 1,000,000 tons through new orders to Italian yards, using facilities granted by the Italian government which has offered to take on its shoulders 33 percent of the cost of building such ships, among which there would be two or three of 30,000 tons.

Developments in the refining industry include authorization by the government to Royal Dutch-Shell interests to enlarge the capacity of their plant at La Spezia to a million tons of crude oil charging capacity annually, including the installation of catalytic cracking units, and to the Socony-Vacuum Company to increase the crude oil charging capacity of its Naples refinery to 450,000 tons annually. Permission has been granted to AGIP to build a new refinery at Punta Cugno, near Augusta, Sicily, particularly to supply foreign airlines using the airport at that location.

An agreement between Standard Oil Company of New Jersey and ANIC (Azienda Nazionale Idrogenazione Combustibili) gives the former a 50 percent interest and contemplates the development of the Bari refinery to a yearly capacity of 500,000 tons and the enlargement of the Leghorn plant to 1,500,000 tons.

Agreements have recently been concluded whereby Caltex has purchased an interest in Petrolea S. A., a company owned by Fiat and engaged in marketing petroleum products in Italy. The name of the new company will be Petrolcaltex.

Caltex and Fiat also plan to construct a refinery in the Po Valley, with an initial capacity of 10,000 barrels per day. The operating company, already organized and known as SARPOM (Societa per Azioni Raffineria Padana Olii Minerali), will process Arabian crude supplied by a pipeline connected to a coastal terminal located at Savona, in the vicinity of Genoa. The refined products will be marketed throughout northern Italy.

# ALBERTA REACHES NEW PRODUCTION PEAK

By J. L. Irwin

THE Province of Alberta, Canada, in 1948 established a record in the matter of oil production. The estimated total, 10,973,538 barrels* to compare with the previous record in 1942 of 10,136,296, an increase of nearly one million barrels. Total valuation is $35,127,751.

The principal reason for this increase was the performance of the now famous Leduc field which contributed in excess of four and a half millions to the total figure, to compare with its 372,427 barrels in 1947. Lloydminster, which more than doubled its production on the Alberta side of the field, helped considerably. The appearance of the dramatic Redwater field, which did not get into production until October, was too late to have much effect on the 1948 showing but promises to figure importantly during the current year. The smaller fields of the province gave a grand total increase of about 80,000 barrels. Turner Valley, though showing a decrease of around 600,000 barrels, reduced its decline in comparison with a year ago when its decrease was 900,000.

From January 1947 to December 1948 daily average production rose from 18,167 barrels to about 40,000 for December, an increase of approximately 22,000 barrels or over 100 percent in two years. Yearly production increased in barrels from 6,809,284 in 1947 to 11,000,000 in 1948 and in value from $18,078,907 to $35,686,550.

Opinions from dependable sources express the view that the two years of 1947 and 1948, despite the great progress that has been made and the satisfying oil production increases which have been brought about, are merely preparatory to the major advance in oil development which is to materialize in Alberta. In anticipation of this, a great amount of preliminary work has already been accomplished.

Development in the north end of Turner Valley was continued actively through the past year by Home Oil and Royalite. Discovery by Royalite of what is known now as the deep lime zone was an important feature. Three additional porous zones at lower depths were announced, and old producing wells were successfully deepened to these new horizons. Home Oil carried on its program to the north and northwest of this old established area with continued successes.

The total for Turner Valley in 1948 will be somewhere near a quarter of a million barrels more than Leduc's for the last year, but this leadership appears definitely at an end. In June of 1948 Leduc for the first time exceeded the monthly total of Turner Valley and has maintained the lead ever since. By November its production exceeded Turner Valley's by over 200,000 barrels. Turner Valley, however, has to its credit a cumulative production total of around one hundred million barrels.

By the close of 1948 the Leduc-Woodbend field field had a total of 174 producing wells in comparison with 26 at the beginning of the year. The 174 total includes 10 wells in the Woodbend area adjoining the Leduc field on the north side of the river.

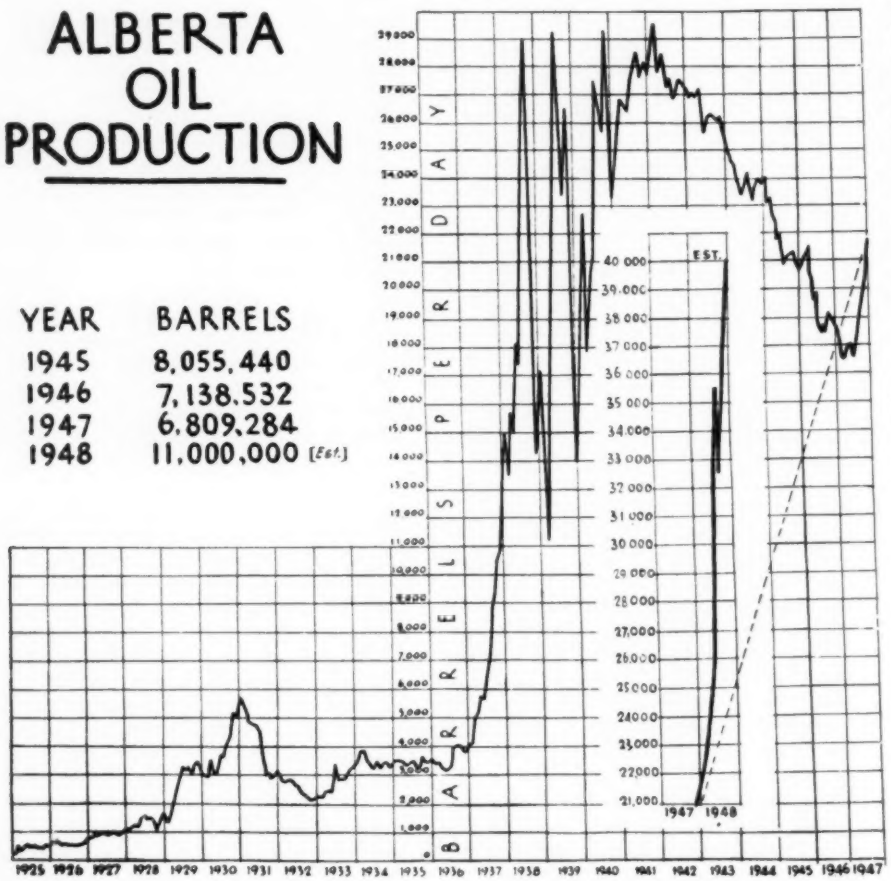
The prospective output of Leduc is estimated at above 200 million barrels, and the potential value of its oil is put at approximately $600,000,000 at current prices. The story of Leduc's discovery and subsequent early history has been told before.* The discovery was made by Imperial Oil Limited on February 13, 1947, drilling having started on November 20, 1946, as the result of a satisfactory seismograph survey.

There are three definite markers or zones in the Devonian limestone known as D1, D2 and D3, the last two being productive of oil. Depths to production are, generally speaking, 5,050 feet to the D2 and 5,350 feet to the D3. Open flow production runs from about 1,000 to 2,500 barrels per day, although some of the wells have been much larger than this. The area is a water-driven oil field, and wells are held down to a fraction of their potentials. Present allowables are still 100 barrels daily from the D2 and 150 from the D3. Production is secured through chokes of varying sizes, all small fractions of an inch.

Since the date of the discovery well's completion, the rustic appearance of the area has greatly changed. Solid gravel roads built to hold up the movement of heavy trucks intersect the former peaceful farm lands. Signposts to guide one to well locations are everywhere. The little townsite of Devon on the bank of the river in the north of the field is expanding all the time. An eight-inch pipeline from railhead at Nisku, eight miles from the field, connects with all producers and crosses the river to the Woodbend field adjoining.

During the spring, summer and fall, a ferry operates on the river and is capable of carrying heavy traffic between Leduc and Woodbend. This constitutes a tremendous saving in mileage. The eight-inch pipeline, after reaching Nisku, travels north a distance of some 20 miles and connects with the new Imperial Oil refinery which was opened officially in July last.

* The word "barrel," wherever it appears in this review, represents the equivalent of 35 Imperial gallons.




* See World Petroleum, 1948: Mar., p. 80; Aug., p. 34.

Leduc has taken on the appearance of a major oil field and has done it in short time. Tank farms and batteries of separators are familiar sights; so are columns of black smoke reaching skyward to announce the arrival of new producing wells. Extensions of the field have been made repeatedly both by major companies and independents. There have been few drilling failures and these mostly on the flanks of the area.

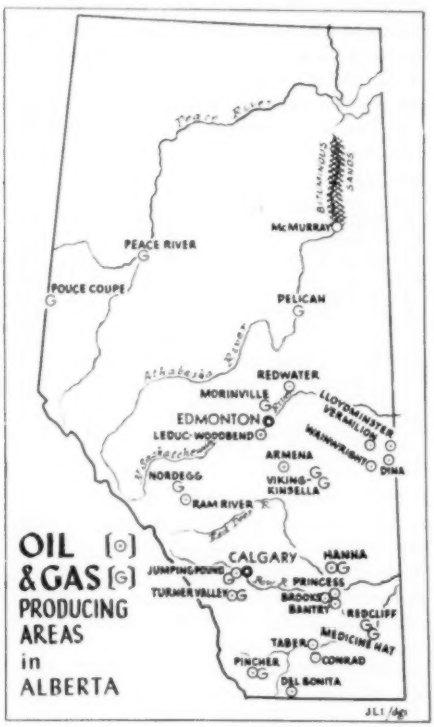
A dramatic incident in Leduc's development was the blow-out of Atlantic No. 3 well. It lasted from March 8 to September 9, 1948, and the gas flow was estimated at 50 million cubic feet per day. In the six-month period the well produced over a million barrels of oil, a quantity equivalent to what would have been its allowable quota over 20 years.

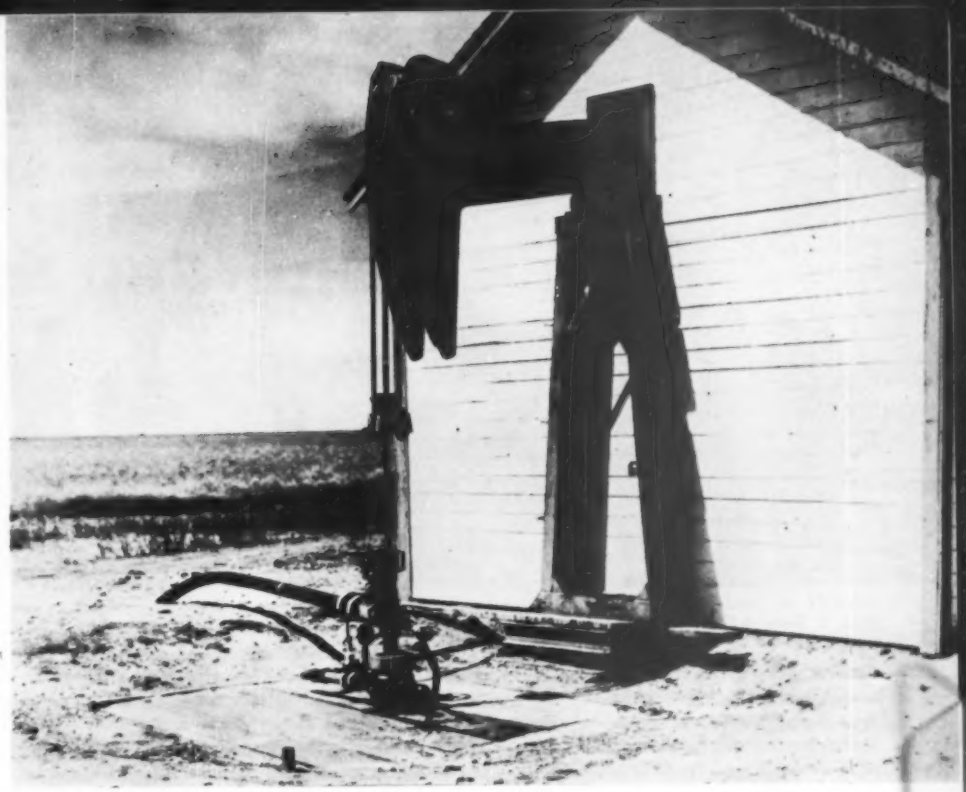
**Leduc Oil Production**
**(Barrels)**

| Zone | 1947 | 1948 Est. |
|---|---|---|
| D2 | 116,246 | 877,989 |
| D3 | 256,181 | 3,742,763 |
| Cretaceous | — | 38,513 |
| Totals | 372,427 | 4,659,265 |

Discovery of major production in the Lower Cretaceous zone above the Devonian was not made until August 1948. This important discovery was made by the Continental Oil Co. of Canada, Ltd., in the northeast of the Leduc field. Allowable production from this zone was fixed by the Conservation Board at an average of 125 barrels per day. The discovery, however, opens a new and important chapter in the field's revelopment.

Completion of Imperial Oil's discovery well at Redwater at 3,264 feet revealed that the drill had penerated Devonian limestone containing



Producing well on pump at Taber Field.

35° gravity crude oil. Daily flow rate was at 1,728 barrels. Subsequent events have proved that this is a field of major proportions, not only comparable with Leduc but possibly exceeding it in productive capacity.

The new field is approximately 40 miles northeast of Edmonton and some eight miles north of the North Saskatchewan Riven. By the end of January 1949 Redwater had seven producers, three belonging to Imperial Oil, three from the Home Oil-Anglo Canadian group and one from P. S. & P. (Pacific Pete, Sunray, Princess Pete and Calvan Pete). This last completion extended the proven area of the field half a mile to the west.

An estimate of Redwater's area and potential from present knowledge gives the field a length of about 10 miles from northwest to southeast, a width of about two miles, and potentials from one to two million barrels per quarter section of 160 acres. Extended out this present estimate would run from 80 to 160 million barrels potential for the field's present proven area. This may be very much enlarged following further development.

The Hanna area has taken a broadening place in the growing Alberta oil picture. Within recent months two oil producing wells have materialized and one wet gasser of major size. The oil wells are important, not only because of the gravity of their oil and the commercial volume of production, but also, and this is significant, because of the fact that they are 16 miles apart. The wet gasser has a daily flow of 21½ million cubic feet with recovery from this of distillate oil, gravity 66°, valued at $3.90 per barrel by latest crude oil price schedule. These are factors which point strongly towards the shaping of still another Alberta oil field of major capacity. The new field is 50 miles to the east of Drumheller and about 150 miles northeast of Calgary. The recent operations were started first by Hanna Petroleums Limited, latest of the Clifton Cross sponsored companies, early in September 1948.

Hanna Pete No. 1 was roughly eight miles to the northwest of the town of Hanna. This was the wet gasser. Hanna Pete No. 2, drilled about 15 miles to the southeast to determine extent of area was a failure. No. 3, two miles to the southwest of Hanna and a mile southwest of the old Berry Creek well which had looked promising, was the first oil producer of the area and, therefore, was the discovery well.

Socony-Vacuum's Craigmyle No. 1, 16 miles northwest of the Hanna Pete discovery well, was also a success. A quick gas flow of 350,000 feet was followed in 20 minutes by a flow of 34° gravity water-free oil. The oil was reached in the top of the Madison limestone at about 4,050 feet. The company, in spite of this success, continued drilling in keeping with its oiginal program to test the Devonian below.

Hanna Pete No. 3 completed drilling at 3,716 feet in the Sunburst sands above the Madison. A test of the Madison was negative. Initial flow was at the rate of 360 barrels per day with gravity at 34°. There was no water. The oil is said to have an excellent lube content.

Following these successes from Hanna Petroleums and Socony-Vacuum-Craigmyle, the area was subjected to a flood of applications for leases, 81 in all being received by the Department of

Scene at Socony-Vacuum's Craigmyle No. 1. Oil burned eight minutes after tester valve was closed.

Lands and Mines at Calgary. Principally two townships were leased, of which Commonwealth Petroleums obtained a reservation of close to one township. Further applications for leases are being received.

The Hanna area makes a unique offering to the industry. Eventually it may be possible for this field to command five different types of revenue, a distinction which so far belong to few productive oil areas wherever they may be. They are sales of crude oil, sales of distillate oil of high gravity, sales of gas for "bottling" due to a marked presence of propane in the gas, sales of gas for domestic consumption, and, if permitted later, sales of gas for export.

Expansion of the extensive Lloydminster field continued in 1948 on both the Alberta and Saskatchewan sides. Production total on the Alberta side more than doubled, and on the Saskatchewan side the increase was well over 50 per cent. Drilling was extremely active; established areas were extended and new ones developed.

By-products of the low gravity oil of Lloydminsted, once despised but now subjected to the respect it has always deserved, are many. They are high-octane gasoline, fuel oil, diesel oil, excellent grade asphalt, bunker fuel for railway locomotives, industrial fuel and particularly lubricating oil. Naphthenic lubricants, such as Lloydminster produces, are stated to be superior because they possess properties which have the ability to dislodge or prevent carbon in internal combustion engines.

In December 1948 Lloydminster's output was reduced, due to restrictions imposed until new markets can be developed for its products. For this reason a number of producing wells were shut down in December, which explains the unexpectedly small totals of producing wells by the end of 1948 shown in Table I.

Other Alberta oil fields, with an estimated grand production total, pending publication of the official totals, of 765,000 barrels for 1948, show an approximate increase of around 80,000 barrels in comparison with such total for 1947.

**TABLE I**

**Lloydminster Oil Production**

| | Alberta | | Saskatchewan | | Combined Field | |
|---|---|---|---|---|---|---|
| | No. | | No. | | No. | |
| Year | Wells | Barrels | Wells | Barrels | Wells | Barrels |
| 1947 | 49 | 308,629 | 73 | 537,076 | 122 | 845,705 |
| 1948 | 62 | 633,955* | 93 | 853,709* | 155 | 1,487,664* |
| Increase | 13 | 325,326 | 20 | 316,633 | 35 | 641,959 |

* These totals do not include figures from Imperial Oil wells in December 1948, which were not available at time this table was compiled.

Note: The above table appears through the courtesy of the Meanwell Accounting Service of Lloydminster.

The three most important of these fields in 1948 were Taber with about 200,000 barrels total for the year, Conrad with about 180,000, and Princess with about 175,000. Other fields contributing to the total were Vermilion, Wainwright, Del Bonita, Dina, Bantry, Jumping Pound, Volmer, Armena, Pincher Creek and Brooks. Hanna's first well arrived too late in the year of figure in 1948 total but will definitely be a factor in 1949. Pincher Creek with its high-grade distillate oil should also be heard from during the current year in the matter of increased production totals.

Two strikes just reported as a result of wildcat drilling promise a further extension of Alberta's production. One of these is the Joseph Lake No. 1, a joint venture of five companies—Superior Oil, General Petroleum, Imperial, Kroy Oils and Jupiter Oils. It is located about 20 miles southeast of the original Leduc discovery and was bottomed at 3,264 feet in Viking sand, flowing 35° gravity crude in a preliminary test. The second discovery is Schoepp No. 1, about four and one half miles west and slightly north of the Woodbend field. It was drilled on Imperial's lands to a depth of 5,380 feet and found 38° gravity oil with a heavy pressure of natural gas. Among the principal natural gas areas of Alberta are those of Turner Valley, Viking-Kinsella, Medicine Hat—Redcliff, Pincher Creek, Pakowki, Jumping Pound, Hanna, Nordegg, Morinville, Pouce Coupé and Pelican Rapids. There are as many again wtih lesser but promising potentialities. In the northern areas of the province, surface gas offers fuel to trappers and prospectors.

Of the principal areas mentioned, only three have been harnessed for use on a large scale. They are Medicine Hat-Redcliff, Turner Valley and Viking-Kinsella. An estimate of the potentials of these three, given about two years ago, was as follows: Medicine Hat-Redcliffe, 150 MMMcf, Turner Valley, 345 MMMcf, and Viking-Kinsella, 1,000 MMMcf. This last named, which feeds the Edmonton area and south, has since been raised to 1,500 MMMcf, an estimate considered to be ultra-conservative.

Canada's oil situation, due to all that happened in Alberta, looked brighter at the close of 1948 than it has for many years. The estimated increase for the Dominion of 4,697,902 barrels, shown by the above table, is encouraging. Alberta was responsible for 4,190,716 of this increase, Saskatchewan for 316,633, the Northwest Territories for 149,864 and Ontario for 42,995. The only decrease was in New Brunswick which shows a decline of 2,306 barrels.

**OIL PRODUCTION IN CANADA BY PROVINCES**

**(In Barrels)**

**By courtesy of the Dominion Bureau of Statistics**

| | 1947 Final | | 1948 Preliminary | |
|---|---|---|---|---|
| Province | Quantity | Value | Quantity | Value |
| New Brunswick | 23,129 | $ 32,381 | 20,823 | $ 31,235 |
| Ontario | 131,295 | 350,000 | 174,290 | 463,611 |
| Saskatchewan | 537,076 | 614,156 | 853,709 | 995,570 |
| Alberta | 6,809,284 | 18,078,907 | 11,000,000 | 35,686,550 |
| Northwest Territories | 227,474 | 500,238 | 377,338 | 830,143 |
| Totals | 7,728,258 | $19,575,682 | 12,426,160 | $38,007,109 |

**NATURAL GAS PRODUCTION IN CANADA BY PROVINCES**

**Quantities in M Cubic Feet**

**(Reproduced by courtesy of the Dominion Bureau of Statistics)**

| | 1947 Final | | 1948 Preliminary | |
|---|---|---|---|---|
| Province | Quantity | Value | Quantity | Value |
| New Brunswick | 489,810 | $ 279,790 | 416,826 | $ 237,590 |
| Ontario | 7,785,921 | 5,334,991 | 9,032,913 | 6,142,380 |
| Saskatchewan | 274,193 | 68,891 | 387,212 | 38,719 |
| Alberta | 44,106,643 | 7,745,886 | 46,800,000 | 8,190,000 |
| Totals | 52,656,567 | $13,429,558 | 56,636,951 | $14,608,689 |

N.B.: It is important to remember in valuations of natural gas, as shown above, that this table has reference only to industrial valuations after the gas has been transported from the fields and must not be confused with well-head prices which, as far as Alberta is concerned, are the ones generally given in official reports from that province.

# PROGRESS ON SYNTHETIC FUELS

IN reporting to Congress on the progress of the research program of the Bureau of Mines relating to the production of synthetic liquid fuels, the Secretary of Interior, Mr. Krug, again refers to the danger that the United States will depend solely upon natural petroleum until the supply becomes critical. To cushion such a crisis he believes that there should be prepared the base for a synthetic petroleum industry ready to step into the breach.

To accelerate the founding of such an industry, two bills that Congress failed to act upon in 1948 have been reintroduced. These bills would authorize federal loans to private industry for the construction of plants that would produce oil and gasoline from coal and oil shale. Supplies from such a source, with careful conservation of reserves of natural petroleum, the Secretary says would assure to the United States an adequate amount of oil for centuries to come. Preparation of this supply should begin now. At the best it would require five to ten years to develop a really significant capacity for synthetic fuels.

The Secretary points out that in 1948 the United States definitely became a net importer of oil, and in spite of an unprecedented domestic production, these imports were barely sufficient to meet the demand. If this situation develops to the point where the country must rely heavily on foreign oil it will run great military and economic risks. Should an emergency arise the nation will be caught unprepared.

The situation as regards domestic production of natural petroleum is not too encouraging, says Mr. Krug. Virtually half of the oil produced in the United States comes from only 111 major fields, and it is apparent that new large fields must be discovered, at least as rapidly as the older ones lose productive capacity. But from 1940 through 1947 only eight major fields with estimated reserves of 100 million barrels each were discovered and proved in the United States. It is true that further drilling in existing fields will provide reserves larger than those now known, but unless there is a pronounced increase in the number of major discoveries, the prospects for sustaining domestic production over a long period are none too hopeful. In view of the enormously increased requirements for oil in transportation, in industry, on the farm and in the home, the dependence of the United States on oil is growing broader and greater; it is necessary that we have assured oil supplies not for just a few years but for an indefinite period. All signs point to the need of a synthetic fuels industry that could fill this foreseeable gap between supply and demand. The alternative to the development of synthetic fuels is restrictions on the public use of oil, to which the Secretary is opposed.

In Mr. Krug's opinion the synthetic fuels industry should be established, owned and operated by private industry the role of the government being confined to providing the necessary financial assistance. This is the object of the two bills now before Congress. (H.R. 566 and S. 6).

The Secretary has received assurance from James Boyd, director of the Bureau of Mines, that the Bureau's laboratories and demonstration plants have made substantial progress in developing a pattern of knowledge that ultimately will assure the practicality of a synthetic fuels industry. The technical progress that has been accomplished in this field, plus the increased cost of discovering and producing petroleum, has narrowed the cost differential between natural petroleum and the synthetic products.

The report gives some details on the present status of the projects of the Bureau of Mines in this work.

Erection of a 200 to 300 barrel-per-day plant for demonstration of coal hydrogenation at Louisiana, Mo., is now substantially complete, with an operating crew assembled and trained. From operations of a smaller pilot plant the Bureau of Mines has made estimates of the costs of synthetic gasoline produced in a 30,000 barrel-per-day plant. These costs would range from 12 to 15 cents a gallon, without figuring in the values of the accompanying by-products. If credit is taken for liquefied petroleum gas at eight cents a gallon and for phenols at ten cents a pound, the cost of synthetic gasoline would be reduced to around eight cents a gallon, which virtually places it on a competitive level with the natural product. This reduction in the cost of gasoline from coal has been made by discovery of a "basically new approach to the hydrogenation process" that has been incorporated in the Louisiana demonstration plant.

The Bureau of Mines gas-synthesis demonstration plant at Pittsburgh, which will have a capacity of 100 barrels daily, will go into operation some time in April, 1949. This plant will gasify coal with oxygen and superheated steam and convert the gaseous product into liquid fuels by a modified form of the Fischer-Tropsch process. "Fundamental improvements" on this process are said to have been made. The engineering problems connected with this synthesis are difficult and much pilot plant development work will still be required, but so far the results have been very encouraging. For the coal gasification, use will be made of a vortex combustor, a unique device in which the heat evolved per unit of space is about 100 times as great as in most other combustion chambers.

Some unique studies on the gasification of coal as a source of gas for the Fischer-Tropsch synthesis have been made at the Bureau's laboratories at Morgantown, W. Va. Here pulverized coal was entrained in superheated steam containing oxygen. The steam was heated to unprecedented temperatures approaching 3,600°F. Ultrasuperheated steam reduces the amount of oxygen required. A pilot plant using this principle has been continuously in successful operation for several months.

A new experiment on the underground gasification of coal in a mine at Gorgas, Ala., is now getting under way.

During 1948, it is said, striking advances were made toward developing low-cost methods and equipment for mining oil shale in Colorado. In a 20-day test under full-scale operation, 81 tons of shale were taken from underground per man-day; this compares with 5½ tons per man-day in deep coal miles. Direct mining costs were only 50 cents a ton. With improved drilling equipment two men can bore 90 feet of blastholes per manhour instead of eight as formerly.

Exploratory core-drillings have materially confirmed estimates that Colorado alone contains 200 billion barrels of recoverable shale oil—six times as much as the whole world has consumed since the first oil well was drilled in 1859.

Preliminary work with a new continuous retort for extracting oil from shale, known as the gas-flow retort, may prove suitable for economic recovery of oil from American shales. Refining research has confirmed that hydrogenation is the most feasible method for producing high yields of easily treated, high quality products from shale oil.

The report closes with mention of progress on liquid fuels from agricultural wastes, particularly corncobs, and the hulls of cottonseed, oats and rice. A survey indicates that in Illinois the farmers could furnish 1,500,000 tons of corncobs for this purpose.

Testing the Wadiel Feiran discovery on Sinai Peninsula.

# Three Sinai Peninsula Fields Promise Greater Egyptian Output

DISCOVERY of a third field on the Sinai peninsula is indicated by the recent completion of an oil well by Standard Oil Co. of Egypt, at Wadi el Feiran, some 92 miles south of Suez. The well produced on test an average of about nine barrels per hour of 23-25 gravity crude through a quarter-inch choke.

Standard spudded in the well on August 19, 1948, and drilled to basement at 6,627 feet. Electric logs indicated possible production at about 6,505 to 6,570 feet, and tests of this interval were made. Producing horizon has been identified as sands in Globigerina marls of Miocene age.

Location of the well is about one mile from the shore of the Gulf of Suez, so water transportation will not be difficult in case that mode of movement to market is selected. Pipeline transportation may be decided on, however, if the field proves to be a good producer, because of the high tolls on oil traffic through the Suez Canal. The Wadi el Feiran well is the first significant discovery by Standard of Egypt which has spent about $12 million in exploration and wildcatting in Egypt.

First discovery on the Sinai peninsula was made about 25 miles south of Suez in May 1946 when Sudr 1, drilled by Anglo-Egyptian Oilfields, Ltd., to a total depth of 3,157 feet was completed, pumping 367 barrels a day of 22° API gravity oil. Thirteen additional wells have since been drilled by Anglo-Egyptian Oilfields on the Sudr lease resulting in a total of nine producers. Sudr 15 is now drilling.

Average depth of the producing horizon in the Sudr field is approximately 2,750 feet. The age of the producing zone is from basal Miocene sands and conglomerates and from Eocene limestone. Several of the Sudr wells have been good producers, Sudr 12, for example, having gauged 4,160 barrels daily through a ¾-inch choke.

Daily production from the Sudr field, which Socony-Vacuum Oil Co. shares equally with Anglo-Egyptian Oilfields, Ltd., recently has been in the neighborhood of 14,000 barrels per day. The oil is being piped to a loading terminal near the Sudr field from which it is shipped by tanker to the Anglo-Egyptian refinery at Suez. Shipments reported for October averaged 14,384 barrels a day.

Second producing field is known as the As1 field located about 40 miles south of Suez and some 10 miles south of Sudr. This field is located on a lease covering 24,710 acres on which oil was discovered in well As1 2. This well was spudded in on August 25, 1947, and completed January 26, 1948, at a total depth of 3,910 feet. After acidizing As1 2 tested initially 3,060 barrels daily of 22° API gravity oil through 2½-inch tubing.

The first well on the As1 lease was drilled by Anglo-Egyptian at a location five-eighths of a mile north of the discovery well and was eventually abandoned as a dry hole. All subsequent wells were drilled by Socony-Vacuum Oil Co., Inc., which holds a one-half interest in the As1 field with Anglo-Egyptian Oilfields, Ltd., owning the other half.

The third well, As1 3, located 1,300 feet east of the discovery well, was dry. The fourth well, As1 4, located 1,300 feet west of As1 2, was drilled to a total depth of 3,334 feet and also tested approximately 3,000 barrels daily through open tubing. The most recent well, As1 5, is located 1,300 feet south of As1 4. On the basis of three producers an area of about 200 acres can be considered the proved acreage of the As1 field. A six-inch pipeline about 10.6 miles long is being laid from the As1 field to connect with loading facilities of the Sudr field.

As1 No. 5 created a considerable stir recently when it was reported as a 40,000-barrel well, and the discovery compared with great fields in Saudi Arabia and elsewhere in the Middle East. Actually the large figure was on the basis of an open flow for a very short time. Tested through a 7/16-inch choke the well showed a producing capacity of 1,615 barrels daily. It is thus comparable to a number of wells in Sudr.

The structure in the Sudr field is extremely complex as is suggested by the accompanying map showing the locations of the dry holes which have been drilled in the field. Experience to date at As1 indicates that this structure also may be complex and fraught with the danger of drilling dry holes as offsets to good producers. Surface geology is impossible in the region; only the drill can reveal underlying faulting.

Until the discovery of the Sudr field, production of older Egyptian fields has been far below the nation's requirements, averaging around 25,000 barrels daily for the past five years. Principal production was coming from the Ras Gharib field discovered in 1938 on the west coast of the Gulf of Suez, which averaged about 23,000 barrels daily compared with about 1,000 barrels daily from the older Hurghada field discovered in 1913.

The Egyptian government is anxious to develop greater production because of the economic drain caused by the importation of foreign oil and is using the new 1948 oil law to implement this policy. During the past year Egypt has consumed in excess of 45,000 barrels of oil daily and has produced about 35,000 barrels per day, requiring an importation of about 10,000 barrels from other countries.

Under the new Egyptian oil law enacted in July 1948, a prospecting permit is required before any exploratory work may be done on either private or public lands. Owners of the surface must obtain prospecting licenses and subsequent exploitation leases.

As mentioned above, government policy under the new law is to encourage expeditious exploration of licensed areas. This is accomplished by radical increases in fees after the first year. The license fee for a minimum tract of 2,500 hectares is £10 Egyptian for the first year, and this is increased tenfold to £100 for the second year. Thereafter the fee increases considerably to £25 Egyptian per square kilometer or £2,500 per year for a 100 square kilometer tract per minimum tract per year. A second stipulation is that the exploration work be carried on in "a serious manner." Annual renewals may be granted up to four years but not for a fifth year unless a rig has been started during the fourth renewal period and consigned to operate continuously thereafter. Another device adopted to speed development is a ruling that all exploration license areas must be surveyed within 60 days after the license is issued.

After a producing well has been brought in on an exploration license area, the oil company may obtain an exploitation lease on half of the area originally granted at a royalty rate of 15 percent. Additional mining leases will be granted within

the area at a royalty of 25 percent, but each lease must contain at least one producing well when the lease is signed, and the least must be applied for at the same time as the original exploitation lease.

A minimum lease rental of £25 per hectare per year is fixed for exploitation leases but royalties are credited against this sum, and if the government elects to receive royalties in kind, lease rentals are returned if royalties equal or exceed them.

Leases drafted under the new law require lessees to refine all oil produced in Egypt. Exportation of oil is forbidden except in exceptional cases and by special permission of the Department of Mines and Quarries. Lessees are required to meet specifications for refined products established by the government and to sell at prices fixed by the government. In case of lessee sells his crude to another company, he is obligated to require the buyer to observe all regulations regarding exportation of oil, quality and resale price of product.

The law itself and leases tendered oil companies since its passage, require lessees to sell to the Egyptian government up to 20 percent of the oil produced or products refined from it at ten percent less than world market prices. In case of disagreement regarding the world price, lessees are to pay a price fixed by the Department of Mines and Quarries but have the right of a court appeal. If the producer doesn't own a refinery in Egypt, he is not absolved from the duty of supplying products refined from the oil to the government. It will be his duty to have the oil processed by another company and to deliver products at 10 percent under world markets.

Proposed lease forms which have been drawn up by the Department of Mines and Quarries contain a considerable number of regulations which are not embodied in the law as enacted last July. Leases stipulate that lessees will be bound to conform to all future orders of the Department dealing with methods of operation including the housing of workmen or "as to any other matter which the Department of Mines and Quarries may deem it necessary or desirable to regulate in order to ensure the proper working of the oilfields or in the interest of the health, safety or comfort of the persons, whether workmen or others, living in the neighborhood. All such regulations as may from time to time be issued shall form an integral part of this contract."

Lessees must employ resident managers and assistant managers "whose technical capacity is acceptable to the Department." The resident managers and assistants must have power to order into effect any regulations "issued or hereafter to be issued."

General regulations embraced in proposed leases require lessees to notify the Department of all proposed wells, submitting a detailed drilling program for approval. Well spacing is regulated and directional drilling is prohibited. Permission must be obtained for acidizing or shooting.

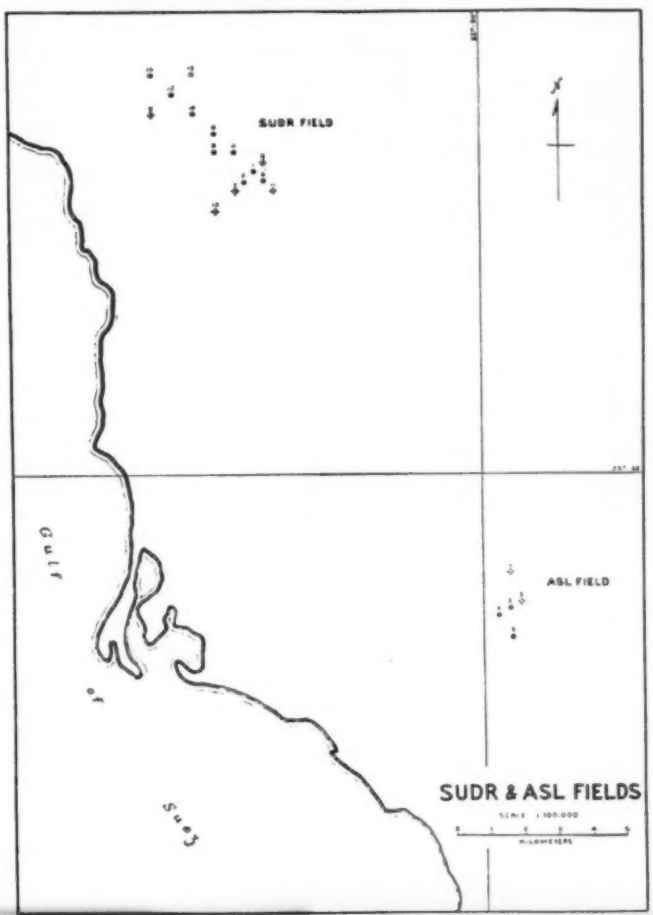
For protection of oil-bearing strata, rules are set up regarding testing of individual horizons, multiple completions, pulling pipe, plugging and so forth. Government inspectors are permitted to use equipment and employees of lessees during inspections and to do remedial work on leases at the expense of lessees if the Department thinks such work is necessary to prevent loss of oil.

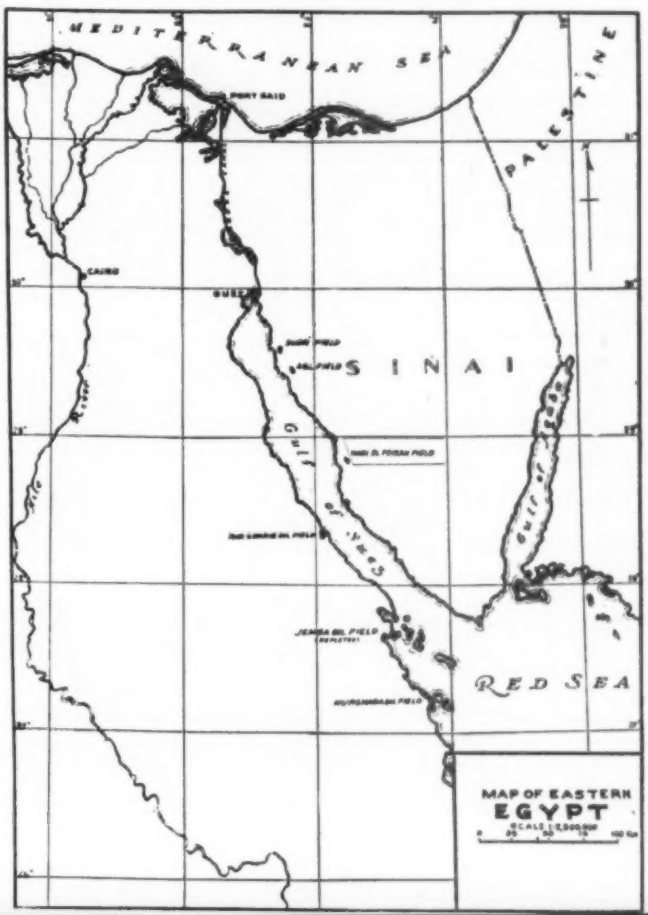
Diligent development of each lease is required by the Egyptian government under its new lease contract. "The lessee undertakes to develop this lease to its utmost capacity and within a reasonable period without any regard to any interests which he may have in other fields in Egypt or other foreign countries," Article 12 recites.

Lessee is required to keep one active rig on each exploitation lease unless production equals at least 1,000 tons per year per square kilometer. Drilling requirement extends through the first 20 years of the lease.

Lessees may obtain permission to lay pipelines without payment of ground rentals. Transportation of government oil in these lines is to be free of charge, however.

Initial term of exploitation leases is for 30 years, and renewals for 15 years are granted on application. At the end of the lease period, property reverts to the government, and for a period of three years, prior to expiration of leases, it is forbidden to remove equipment from the property. Pending negotiation of an exploitation lease at Wadi el Feiran with somewhat less stringent terms than those now proposed by the Egyptian Department of Mines and Quarries, Standard Oil Co. of Egypt has suspended development operations at this location and exploratory surveys elsewhere.



# SEISMIC EXPLORATION WITH SURFACE SHOTS

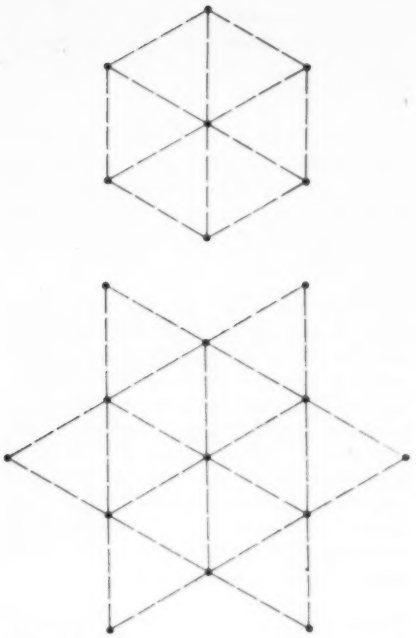
By Walter O. Novelly

Republic Exploration Co.

A SIGNIFICANT development in geophysical exploration for oil is the advent of the Poulter method of surface shooting. Conceived by Dr. Thomas C. Poulter, associate director of the Standard Research Institute, and developed under his guidance and the sponsorship of the Institute of Inventive Research, San Antonio, the method eliminates the use of the shot hole by detonating the explosive charge in the air above the surface of the ground rather than within the ground.

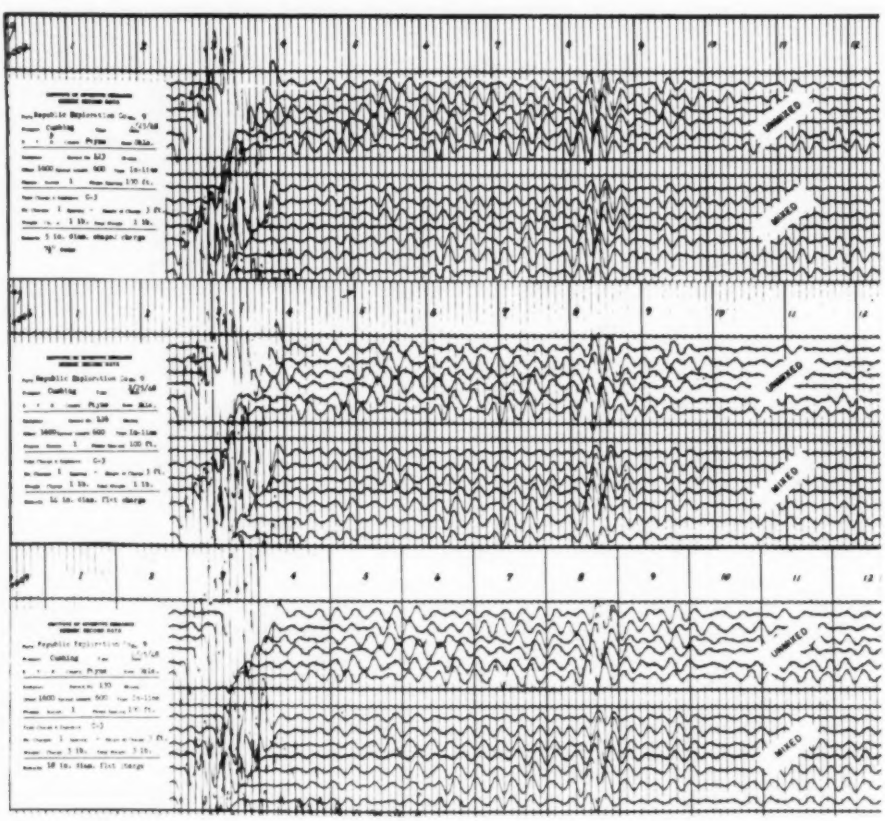
Surface shooting has thus far been carried on in the Edwards Plateau area of West Texas, caliche covered areas of West Texas and New Mexico, the lower Rio Grande valley, East Texas, the Texas and Oklahoma Panhandles, northwestern, southwestern and central Oklahoma, Wyoming and Alaska. In all cases the surface shots were at least as good as the hole shots, and in several instances were much better. Shooting on the caliche surface of New Mexico yielded outstanding results. On the Edwards Plateau, while neither method gave usable reflections at many points, the character of the surface shots was better than that of the hole shots, and in many cases reflections were obtained where the holes gave no results.

Dr. Poulter first became interested in the possibilities of transmitting energy into the ground by firing charges above the surface when he was senior scientific adviser on the second Byrd Antarctic Expedition in 1933-35. Observations of the transmission and absorption qualities of the ice led to the discovery that charges fired within the ice gave far less energy return at pickup stations than charges fired in the air.



Figs. 2 & 3. Plan of 7-charge and 13-charge star patterns. Distances between adjacent charges have been varied from 20 to 100 feet in experimental work. A high degree of precision in laying out the pattern is not required.

Fig. 1. Three of earliest surface records. Taken February 1948 in Payne County, Oklahoma, with single charge of one pound, three feet above surface. Shot point to first phone is 1600 feet; spread length is 600 feet.




Back in the United States, Dr. Poulter pursued these investigations by making studies of a similar nature on rock materials. It was found that deformation of the rock surrounding a charge may account for an energy loss as high as 95 percent, the exact amount being a function of the intensity of the impulse and the nature of the surrounding material. Detonation of the charge in air, however, showed that very little of the energy is absorbed in that medium at the instant of the explosion and a greater amount is actually transmitted into the ground.

Dr. Poulter's next step was to attempt application of these fundamental principles to the practical project of securing seismic reflections from charges suspended in the air rather than buried in the ground. In this endeavor he was sponsored by the Institute of Inventive Research. All field operations involving tests in various areas were directed by Republic Exploration Company, who, along with Engineering Industries, Inc., of Tulsa, were retained in the capacity of technical consultants.

Analogous to the latitude of the hole-shooting operator in experimenting with shots in different formations or at various depths to get suitable reflections in a particular area is the range of possibilities open to the surface-shooting operator. These include variation of the height of the charge above the surface, the number of

charges used at each shot point, the distances between the charges and the geometric pattern of the group.

The usefulness of several holes shot simultaneously over an area of an acre or less has long been recognized by seismologists. The prohibitive cost of shot hole drilling in such a program, however, has prevented any extensive use of this method to obtain reflections in difficult or "impossible" areas. Surface shooting permits a great amount of flexibility in the use of multiple charges. While good reflections were obtained by surface shooting a single one-pound charge in parts of central Oklahoma (Fig. 1), it was found that where heavy charges are necessary, much better results are obtained by distributing the charge over a large area. Common methods of distribution are the seven-point and 13-point star patterns (Fig. 2 and 3). Multiple charges arranged in squares and rectangles, and in straight lines, both in line with the spread and at right angles to it, were tried with varying degrees of success.

The optimum spacing of multiple charges appears to be dependent on the material and depth of the seismic weathered layer. Where the weathering is deep and made up of loosely consolidated material, wider spacing is required than in areas of compact material and shallow weathering. Distance between adjacent charges have been varied from 20 to 100 feet.

To suspend each charge above the ground for detonation, a metal telescopic pole is used. The central part of the pole is simply driven into the ground. The charge is mounted on a small, expendable wooden block, which in turn is mounted on the movable outer part of the pole. The latter may be placed at any desired height by means of a set screw. In general, the most suitable height for the charge is six to eight feet, although unusually heavy individual charges require a greater height. In the early experiments charges were placed as high as forty feet.

The time break for surface shots is obtained by placing a geophone on the ground under one of the charges. The break then comes in at the exact moment that the energy hits the ground rather than at the moment the charge goes off and represents the true starting time for energy passing into the earth. It is usually necessary to modify the standard blast or to accommodate the large number of caps fired simultaneously and in series.

The strong impact of the sound wave on the geophones of the spread makes it necessary in surface shooting to offset the first phone of the spread by a distance sufficient to allow the desired reflections to arrive before the air blast. Thus, if the deepest reflection expected is at two seconds, an offset of a half mile would be convenient, since the travel time of the air wave from the edge of the shot pattern to the closest phone would be approximately 2.2 seconds. For continuous profiling a skip-spread method is then necessary.

Because of the large number of poles and charges required at each shot point and the distance between two shot points shooting into the same spread, it is found that the shooting unit is far

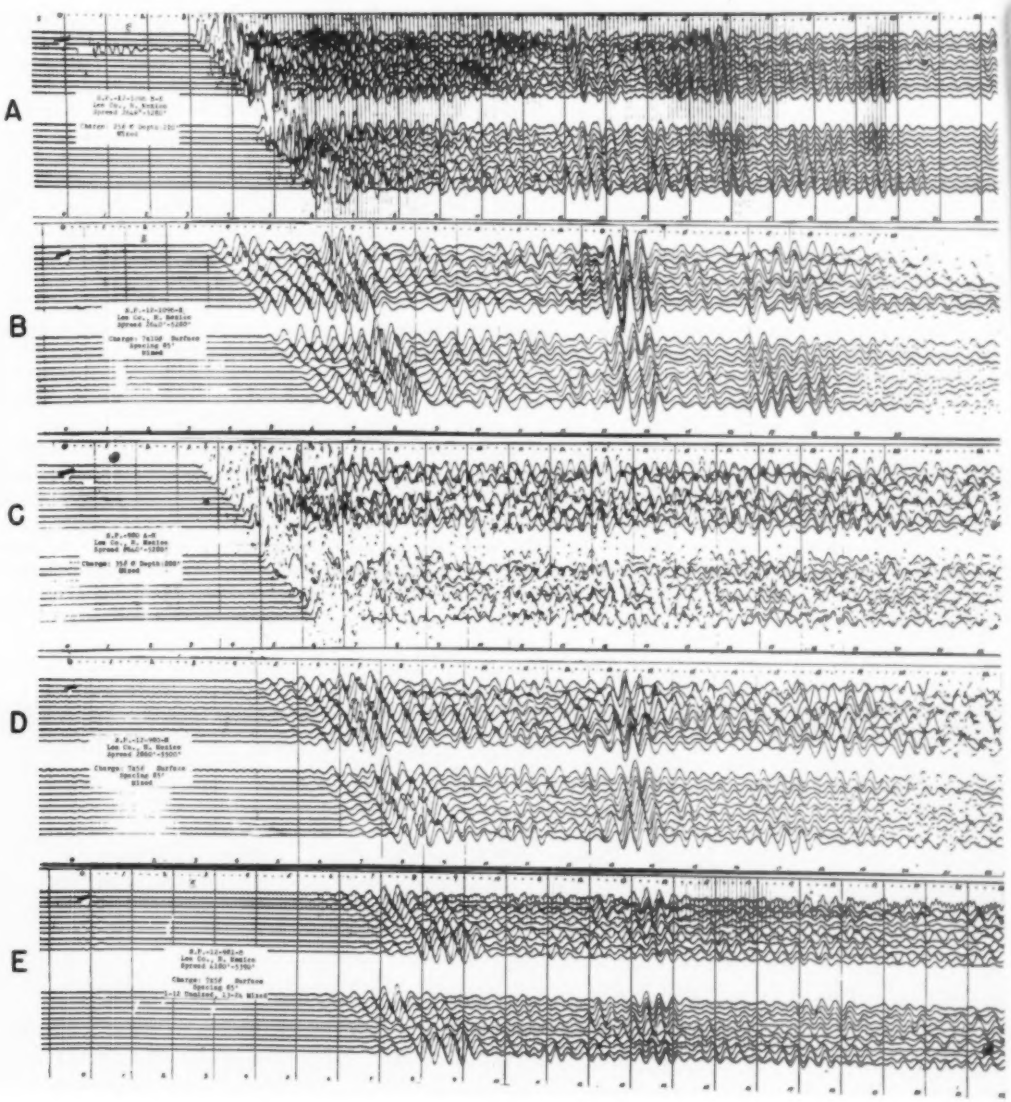



Fig. 4. Records taken in Lea County, New Mexico. A charge of 25 pounds in 210 foot hole. B—Same setup as A, with surface shot of seven charges of ten pounds each. C—Charge of 35 pounds at a depth of 220 feet. D—Same setup as C, with surface shot of seven charges of five pounds each. E—Surface shot of seven charges of five pounds each showing comparison of unmixed (top half) and mixed traces. Surface charges spaced at 85 feet. Note good continuity of refraction events on surface shots.

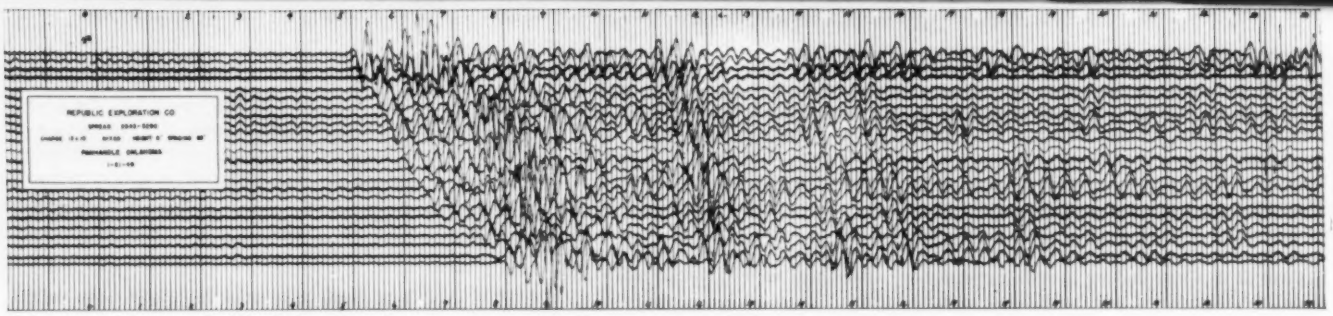



Fig. 5. Record from surface shot in Oklahoma Panhandle where hole records were practically all failures. Effect of air wave is clearly shown.

slower than the recording unit. For this reason it is advisable to be equipped with a shot point set up crew in addition to the shooting crew itself. A distance of 350 feet from the edge of the shot pattern to the position of the shooting truck and crew is considered sufficiently safe for charges of 130 pounds.

While the prospect of eliminating the cost of the shot hole drill may appeal to those using the seismic method in oil exploration, the first question of the seismologist who must do the interpretation is "What about the weathering?" Assuming good reflections from surface shooting, the interpreter is faced with the problem of accounting for weathering effects without so much as an uphole time or first arrivals from close phones to help him.

Several avenues of approach are open. In some areas such as Lea County, New Mexico, (Fig. 4) good first arrivals from a shallow refractor are found and may be followed continuously in the same manner as reflections. Removal of the horizontal travel time leaves a time measure of the material above the refractor, which, in turn, permits the construction of an isopach between the refractor and the reflecting horizon mapped. The validity of assuming that the refractor is of uniform dip, of course, must be ascertained before such an isopach may be used as an indicator of actual structure in the reflecting horizon.

Where it is impossible to carry the first arrivals continuously from hole to hole, it is often possible to correlate a shallow refractor on the basis of in-line velocities and to construct an isopach similar to the one discussed above. An alternate method, when field conditions permit, is to shoot the spreads broadside. First arrivals can then usually be followed continuously across the record and a relative shallow refractor correction made. A disadvantage of broadside shooting is the lack of absolute time ties for both reflections and refractions in going from hole to hole, while an advantage is the superior continuity for both types of events. Another advantage of broadsides is the fact that the shot points are generally further removed from buildings than those for in-line shooting.

In connection with the use of the first arrivals found on the surface shooting records, it may be mentioned here that the arrival time of the air blast on the individual traces can be used for determining or checking distances from the edge of the shot pattern to the closest phone at each geophone station (Fig. 5). The normal velocity of sound must, of course, be corrected for temperature and the velocity and direction of wind.

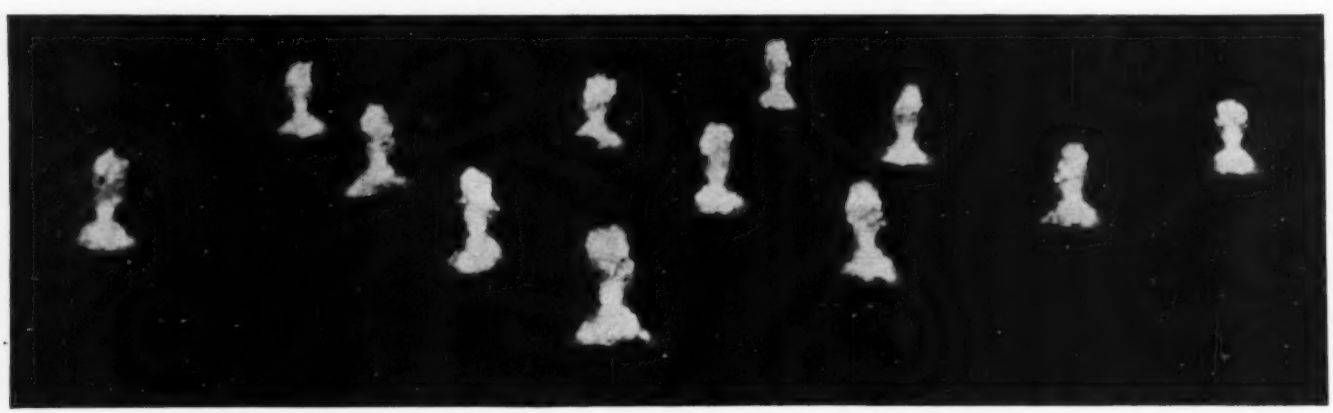
In areas where the nature of the near surface beds makes the use of shallow refractors undesirable, or where the first arrivals themselves are unusable, it may be necessary to use surface or near surface weathering shots at each end of the spread, the weathering correction being computed by well-known refraction methods. In some areas it is possible to ignore the weathering correction altogether because of its thinness and the large relief of the structures expected. This is especially true of many regions where surface shooting is particularly desirable because of the great expense of drilling holes.

With respect to public relations in an area where surface shooting is being carried on, the effect of the air blast often must be considered. While the possibility of subsurface damage is considerably less than with hole shooting, the air wave is capable of much greater damage, particularly from broken glass during cold weather when windows are closed. It is advisable to keep shot points removed from houses by a quarter to a half mile, depending on the size of the charge. The force of impact of the air wave appears to be a function of the size of the individual charges more than the total charge.

The psychological effects of surface shooting are often pronounced because of the loud noise involved. For this reason it is desirable to contact residents in the vicinity of the prospect and advise them of what is taking place. In spite of the noise, the effect of the shooting on nearby livestock appears to be no greater than that caused by hole shooting. In West Texas where a large amount of both experimental and program shooting has been done, cattle and sheep within a few hundred yards of shot points are disturbed very little. The cylindrical charges cause no damage whatever to the ground within the shot pattern, even dry grass and bushes remaining unmarked. In one instance in West Texas, a jack rabbit was observed sitting within the shot pattern as the shot was fired. After the shot it jumped away under its own power with no visible marks of injury.

The Poulter surface shooting method was primarily designed to reduce the high costs of shot hole drilling found in many areas, particularly in the caliche and limestone covered regions of West Texas and New Mexico and the Rocky Mountain districts, where drilling is slow, water usually scarce and roads poor or non-existent. It is a happy coincidence that these areas are also sparsely populated, a condition very desirable for surface shooting in its present stage. Foreign

Twelve explosive charges going off simultaneously during a demonstration of the Poulter Method.



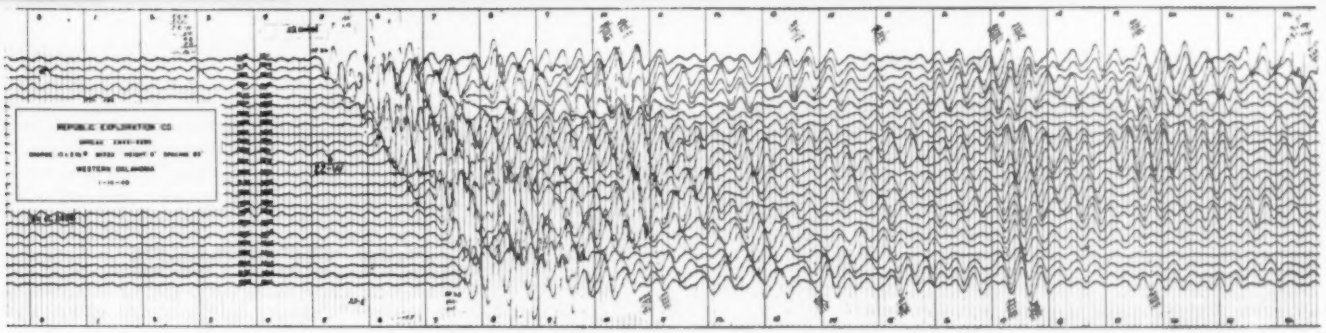


Fig. 6. Surface shot made in western Oklahoma. This record is better than average taken on the particular prospect.

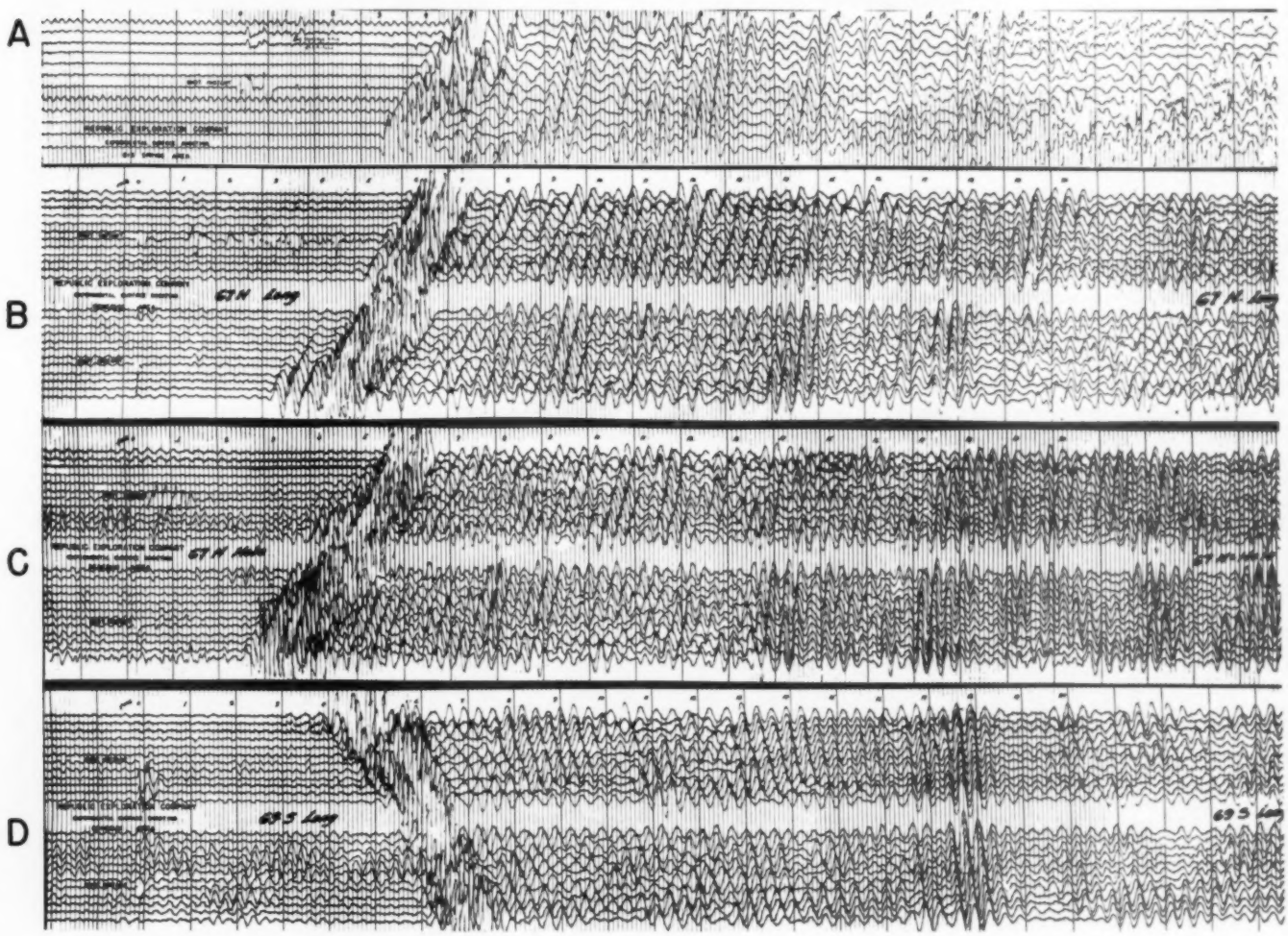
countries also offer good fields for use of the method, as do areas of extremely low temperatures, where it would be highly desirable to eliminate the use of water by both the drilling and the shooting units.

The method is flexible, since two trucks of a drilling unit need not occupy each shot position. If necessary, explosives can be brought to a shot point in a light truck or jeep. Further, the recording truck need never abandon and reoccupy a setup because of a lost hole, but may shoot until a good record is obtained.

In general, in contemplating a surface shooting program, it is necessary to strike a balance between the cost of shot hole drilling, the necessity for redrills, the comparative quality of the records obtained by the two methods, the necessity for avoiding heavily populated districts when using heavy surface charges, the relative speed of the two methods, and the determinability and importance of the weathering correction. The superiority of surface shots over hole shots in some areas has given rise to a tendency to send surface shooting crews into some of the most difficult areas known to seismic prospecting from the standpoint of reflection quality. It should be stressed in evaluating the worth of the method, however, that it was designed primarily to reduce the high cost of shot hole drilling and not to shoot heretofore "impossible" areas.

In conclusion, it must be borne in mind that surface shooting is still in its infancy and there is much room for further experimentation and its consequent refinements. Areas not yet tested by this method may lead to more definite correlation between heights and spacings of charges on one hand, and the depth of weathering, near surface material, geologic section and depth of reflecting horizons on the other. Results to date have been very satisfactory, and it is believed that the near future will see an extensive application of the Poulter method in many areas.

Fig. 7. Records taken in the Big Spring-Rankin area of West Texas. Note interference of air blast on reflection at 1.6 seconds on surface record A. Records B and C show comparison of surface and hole shots on same setup. The probable multiple reflections on the hole shot are missing on on the surface shot. Record D is a surface shot.



# THE RISE OF BRITISH BORNEO

Erecting derrick at off shore well 107 prior to rehabilitation. All photographs courtesy Shell Photographic Library, London.

Oil well at Balikpapan, Borneo. →

BRITISH Borneo is the northern portion of the island of Borneo in the East Indies and comprises the Crown Colonies of Sarawak and of British North Borneo and the independent native state of Brunei.

There are two oil fields in British Borneo. The more important is at Seria in Brunei, discovered in 1929 after several years of detailed geological investigations along the coast and inland swampy jungle bordering the South China Sea. The operator is the British Malayan Petroleum Co. Ltd., a Royal Dutch-Shell subsidiary. By 1941 oil drilling operations had been extended for over five miles along the beach and inland for a depth of nearly a mile, and undersea drilling had also been carried out from several jetties built from the beach extending up to 800 feet out to sea. The technique of directional, or slanting, drilling was a method employed to deviate some of these wells several hundred feet further seaward. At the end of 1939 44 wells were producing 16,200 barrels daily.

To the southwest of Seria, Sarawak Oilfields Ltd., another subsidiary of the Royal Dutch-Shell Group, operates a field at Miri in Sarawak. The first to be discovered, in 1911, it was producing in December 1939 an average output of 3,100 barrels daily for 420 wells. That Seria is the more prolific field is amply demonstrated by the total cumulative production figures for both fields. By June 30, 1948, as much crude oil had been extracted from Seria in 19 years as had been taken from Miri in 38 years; namely 69,925,000 barrels from Seria and 70,635,000 from Miri.

The crude oil production in Sarawak and Brunei in 1939 was 1,224,000 and 5,532,000 barrels respectively. Both fields were connected by pipeline to a refinery at Lutong which had a capacity of 20,000 barrels daily. This installation was not on a very large scale and was designed solely to treat the crude produced in its area.

The British officials who were administering the native states of Sarawak and Brunei (Sarawak did not become a Crown Colony until 1946,) were equally prepared for a Japanese expansionist policy as were the Dutch authorities in the Netherlands East Indies. Denial measures had been made ready to meet all eventualities, and, when the blow fell, were put into operation with all dispatch. The systematic destruction of all means of production and refining was started on December 8, 1941, and was reported successfully completed without accident to employees.

When the Japanese occupied the East Indies, their army and navy divided the oil facilities between them. The navy obtained those on the east coast, Balikpapan and Tarakan, while the army acquired those in the rest of the Indies, including Seria, Miri and Lutong. Repair work was as rapidly put into train in British Borneo as in all other areas, and during the four-year period of their occupation the enemy produced a total of 11,489,000 barrels from Seria and Miri.

Production under the Japanese reached its peak in 1944. In the Dutch colonies, on the other hand, production in all areas steadily diminished after 1943, owing to Allied bombing attacks and the anti-submarine campaign. The more favorable performance in British Borneo may be attributed to its comparative freedom from serious air attacks until October 1944, when a series of Allied bombing raids over Borneo caused considerable damage to the installations at Lutong.

When Australian forces reoccupied the island in June 1945, they were met with a scene of utter devastation—blazing wells, demolished buildings and wrecked installations. Within three months the stupendous task of extinguishing 37 separate oil-well fires was successfully concluded by Shell technicians in conjunction with military personnel. Drilling was soon resumed and repair strings were to improving the existing wells to overcome as far as possible the consequences of Japanese neglect. Although staff and

labor, materials and equipment were brought in as early as possible, unparalleled difficulties unknown to normal oil-field development had to be met. The first milestone on the road to recovery was reached in March 1946, when the first tanker was loaded with Seria crude for refining in Australia. Refinery operations were commenced at Lutong in December of the same year. Three years have now elapsed since the end of the war, and the Seria oil field has made such progress that it produces from 142 wells more than threefold its prewar rate of output—a total of 59,000 barrels daily by September. It is a very creditable performance in view of the difficulties the companies have had to face. And the recent reports of the erection of a permanent settlement at Seria to house oil workers is sufficient evidence of the importance that the Royal Dutch-Shell Group attaches to the future of this field.

War damaged and new tanks in oil tank farm at Seria.

The Miri field is now producing about 1,000 barrels daily. This is still a long way behind the prewar rate, but shortage of equipment and transport is retarding full-scale rehabilitation and expansion. It is hoped to increase production both by new drilling and rehabilitation of old wells, but it must be remembered that the field has now reached a very mature stage, and known reserves are extremely limited. It is significant to observe that the number of producing wells in Miri is only 106; that, whereas in 1939 it had ten times as many producing wells as Seria, it now has only just over half as many. Exploration for new reserves, however, is still being undertaken.

The refinery at Lutong had been completely destroyed at the time of the reoccupation, and so restoration had to start from scratch. Some units of the old plant were soon put back into working order, and a complete new refinery was brought over from the United States and erected on the same site. Refinery capacity is now up to 35,000 barrels daily. Eventually it is planned to replace the Lutong refinery by a new modern refinery.

The story of the postwar rehabilitation of oil properties in British Borneo is complementary to that of the Netherlands East Indies. Together they form one producing area. But an account of their recovery from the ravages of war must take note of the essential dissimilarities in the problems confronting the two areas. In the first place, reconstruction was possible in British Borneo straight away from June 1945, when the two oil fields and the refinery were recaptured; and it has been able to proceed undisturbed by the political unrest that has swept across the Dutch colonies in the past two years. In the Netherlands East Indies, on the other hand, much of the oil property still remains inaccessible, and, until the present political uncertainty is cleared away, the future of its postwar recovery program must be viewed with a certain amount of caution. No such doubts exist in British Borneo. It has been free to devote all its resources and energies to the task of rehabilitation, with such a measure of success that it has now wrested from Trinidad the position of chief oil producer in the British Empire.

**BRITISH BORNEO PRODUCTION SUMMARY** June 30, 1948

| | Sarawak | Brunei |
|---|---|---|
| Field | Miri | Seria |
| Year of discovery | 1911 | 1929 |
| Footage drilled | | |
| 6 months 1948 | 6,153 | 39,612 |
| Wells completed | | |
| 6 months 1948 | | |
| (a) oil wells | NIL | 7 |
| (b) gas wells | NIL | NIL |
| (c) dry holes | NIL | NIL |
| Wells drilling | 1 | 3 |
| Wells suspended | 2 | 2 |
| Flowing wells | 1 | 59 |
| Pumping wells | 79 | 1 |
| Gas lift wells | NIL | 34 |
| Oil wells shut in | 12 | 14 |
| Producing depths | 300-3000 ft. | 1600-6400 ft. |
| Total production | | |
| 6 months 1948 | 166,000 | 7,394,000 |
| June production, b/d | 970 | 52,000 |
| Cumulative production | 70,635,000[1] | 69,925,000[2] |
| Base of crude | Mixed | Mixed |
| Gravity of crude | 21.5°-43°API | 19°-33°API |
| Producing formation | Tertiary sands | Tertiary sands |

[1] Includes 710,000 barrels estimated production during Japanese occupation.
[2] Includes 10,779,000 barrels estimated production during Japanese occupation, but excluding fire losses.

Wrecked refinery equipment at Lutong.

Oilfield in Tarakan.

# SALT MINE TEST PROVES EARTH PENETRATION BY RADIO WAVES

**The successful demonstration that radio waves may be transmitted to depth in the earth, such as described in the accompanying article, is believed by some authorities to presage the opening of an entirely new field of geophysical exploration. In the April issue of WORLD PETROLEUM there will appear an article by Wm. M. Barret describing the operating principle of the new method used in the demonstration. Editor.**

W. M. Barret (center) explains to a group of visiting scientists a part of the transmitting equipment used in the radio-transmission demonstration.

IN a dark tunnel of a deep salt mine, engineers of William M. Barret, Inc., geophysicists of Shreveport, La., recently showed publicly for the first time a new tool for the use of oil and mining companies in their search for deposits.

For the demonstration, 23 prominent scientists, representing four technical societies and the U. S. Air Force and U. S. Navy, assembled at the bottom of the Morton Salt Co.'s Kleer mine shaft at Grand Saline, Texas; trudged through 1800 feet of abandoned workings, and listened to the sound made by radio waves coming from a transmitter 1200 feet away on the surface.

The fact that strong signals were received from a small transmitter after traveling through some 700 feet of sedimentaries including freshwater sands, about 25 feet of cap rock carrying five to nine feet of salt brine, 400 feet of salt and 100 feet of air, led research experts from leading oil companies to state that the demonstration had important implications in prospecting for oil and other minerals. Air Force and Navy representatives were frank in acknowledging that the system may have vital applications for national security, especially if industries are moved underground in the case of atomic warfare. Mining engineers expressed the belief that the new development might be useful as a means of communication in mine disasters.

W. M. Barret, president of William M. Barret, Inc., said that the system demonstrated was the result of a company research program extending over 15 years. He pointed out that the system represents a basically new approach to the problem of transmitting radio waves through the earth.

According to Barret, the widely held belief among radio engineers and geophysicists that radio waves can be transmitted but to relatively small depths in moist earth is based on the unfavorable results of earlier transmission experiments wtih conventional radio equipment. In the prior experiments much of the transmitted energy failed to enter the earth because of the enormous reflection loss at the air-earth interface, and what wave energy finally arrived at the receiver had traveled such a narrow ray-path section that attenuation had reduced its overall amplitude below useful levels.

The new system makes use of unique transmitting and receiving apparatus designed to overcome the reflection of waves at the ground, and to compensate for the attenuation of the waves in the earth by an increase in the effective ray-path section. To accomplish this, a surface wave is directed along the air-earth boundary by a new type of radiating device, and as the wave moves it is progressively refracted into the earth along parallel ray paths. On striking various sub-surface strata, or mineral deposits, the waves are partially reflected along parallel ray paths back to the earth's surface, where they are again refracted at the air-earth boundary and rejoin the surface wave. Reflection losses at the earth's surface are thereby minimized, and a receiver operated on the surface is effective in detecting the energy returned from depth since all of the rays reflected by a particular subsurface reflector arrive at the receiver in time phase and space phase, and hence their cumulative action adds enormously to the intensity of the received signal.

The attenuation suffered by any given ray may be large, depending on frequency and other fac-

tors, but if a correspondingly large number of rays are added together properly at the receiver, then the cumulative effect of all the rays results in signals that are easily detected. Past investigations by Dr. Barret indicated that the operable depth of the new system is far greater than the depth involved in the Grand Saline demonstration. The Grand Saline mine was selected for the demonstration because of the variety of geologic media present and their rather complex structural attitudes; the possibility of isolating the underground receiver against signals entering the mine through the air or by metallic conductions, and the convenience of the mine location for the visiting scientists.

In carrying out the demonstration at Grand Saline, only one half of the operating cycle was utilized, namely, the transmission of waves into the earth. In detecting the waves in the salt mine, a special type of pick-up device was employed, which so increased the effective day-path section that signals of tremendous volume could be heard over a loud-speaker connected to the receiver. The transmission took place at a frequency of 1602 kilocycles.

Elaborate precautions were taken at the top and bottom of the mine shaft to insure that no radio signals could reach the receiver through air or metal at the shaft. The electric power and telephone lines were cut and grounded at the top and bottom of the shaft. The water line and pneumatic-signaling tube were grounded top and bottom. The hoist cable was grounded at the hoist, at the sheaves on top of the head-frame, and at the bottom of the mine. The vertical and interconnected reinforcing rods within the concrete shaft lining were shown to be naturally grounded by a heavy seepage of salt brine extending over a considerable vertical interval in the neighborhood of the 200-foot level. All electric lines, telephone lines, water and air pipes within the mine were grounded at various points. And finally, it was explained to the attending scientists that the diameter of the shaft was but 14.5 feet, and since theoretical considerations and practical experience in the radio art showed that its diameter was far too small to act as a wave guide for the 614-foot waves used in the demonstration, it therefore was safe to assume that no waves could enter mine through air in the shaft.

By locating the receiver in an abandoned part of the mine, which was free of metal and removed from the shaft by 1800 feet of circuitous tunnels, it seemed clear that any signal arriving at the receiver must come directly through the earth from the transmitter, which was placed on the surface, 700 feet above the receiver and 1000 feet to one side. The demonstration was climaxed by the reception of a strong and clear code message: "You are now hearing the sound of radio signals that have traveled deep into the earth."

Observers were members of the American Institute of Mining & Metallurgical Engineers, The Society of Exploration Geophysicists, the Institute of Radio Engineers, the American Association of Petroleum Geologists, the U. S. Navy and the U. S. Air Force.

Among those present were: J. Y. Bell, manager of Grand Saline plant, Morton Salt Co., Grand Saline, Tex.; Harry M. Buchner, exploration coordinator, Carter Oil Co., Shreveport, La.; Chas. R. Campbell, consulting engineer, Dallas, Tex.; John A. Cathey, geophysicist, Seaboard Oil Co., of Delaware, Dallas, Tex.; Dr. K. C. Crumrine, physicist, research laboratory, Carter Oil Co., Tulsa, Okla.; Dr. Henry F. Dunlap, senior physicist, The Atlantic Refining Co., Dallas, Tex.; Wm. M. Erdahl, chief geophysicist, Skelly Oil Co., Tulsa, Okla.; James M. Forgotson, consulting geologist, Shreveport, La.; Wm. H. Gibson, seismologist, The Texas Co., Houston, Tex.; Paul L. Harton, instructor in electronics engineering, Southern Methodist University, Dallas, Tex.; Dr. M. King Hubbert, associate director of exploration and production research, Shell Oil Co., Inc., Houston, Tex.; J. F. Johnson and H. J. Jones, geophysicists, Sinclair Prairie Oil Co., Ft. Worth, Tex.; Lt. Com. A. Maeschner, radio engineer, representing the U. S. Navy; John E. McGee, geophysical supervisor, Gulf Research & Development Co., Houston, Tex.; John Mings, administrative officer in charge of radio training for the air training command, U. S. Air Force, Barksdale Field, Shreveport, La.; C. L. Moody, division geologist, Ohio Oil Co., Shreveport, La.; Herbert A. Morris, Jr., electronic engineer, research laboratory, United Gas Pipe Line Co., Shreveport, La.; T. D. Nickerson, geophysicist, The Texas Co., Houston, Tex.; W. B. Perry, geophysicist, Kingwood Oil Co., Oklahoma City, Okla.; Col. Charles W. Richard, radio engineer, representing the U. S. Air Force; E. M. Shook, assistant manager of geophysical laboratory, Magnolia Petroleum Co., Dallas, Tex.; Dr. Daniel Silverman, exploration research supervisor, Stanolind Oil & Gas Co., Tulsa, Okla.; Bailey Summers, geophysicist, Gulf Research & Development Co., Houston, Tex.; J. E. Walker, seismologist, Shell Oil Co., Inc., Shreveport, La.; and Richard M. Wilson, geologist, Ohio Oil Co., Shreveport, La.

In addition to W. M. Barret, the demonstration staff included W. H. McCartney, mining engineer; C. H. Clement, equipment supervisor; G. J. Baker, physicist; E. T. Stone, Jr., field supervisor; F. K. Crider, geologist; C. H. Adair, radio operator, and J. L. Thomas, assistant. Aiding the Barret personnel was J. M. Forgotson, consulting geologist of Shreveport.

This flashlight photograph shows a section of the 1800 feet of tunnels traveled on foot by visitors to the salt mine in reaching the remote location selected for the receiver site.

Receiver in salt mine which picked up radio signals which had traveled through 1200 feet of earth.

# EXPLORATION IN THE PHILIPPINES

THERE are several sedimentary basins in the Philippine Islands which are considered favorable for the accumulation of oil, but the limited amount of exploration work thus far conducted has not developed commercial production. The deep well drilled on Cebu last year had some showings but failed as a producer. Currently a test is being drilled on Luzon.

At the present time exploration is not considered attractive by some foreign companies because of the Philippine government's policy of restricting the area available for geological and geophysical studies and the limitations on exploitation concessions. Government policy is to grant exploration concessions to foreign companies on an area not exceeding 2,471,000 acres. After exploratory work is complete, concessionaires must turn back half of the acreage to the government. Exploration concessions are limited to a term of 25 years and are renewable for 25 years, but this renewal is not considered certain since the oil administration is limited by law to contracts which do not exceed a term of 25 years.

Immediately after the war a number of foreign companies indicated interest in Philippine concessions but in some instances were discouraged when they were unable to obtain large concessions covering areas up to 12 million acres for exploratory work. Considering the expense of such exploration, the foreign companies felt that they should be permitted to improve their probability of success by studying larger tracts. Sedimentary deposits are exceedingly thick in some areas and geophysicists have experienced difficulty in deciding whether geophysical highs were true geological structures or limestone reefs.

First well on Cebu was begun near Daan Bantayan on the northern tip of the island in 1940. On December 6, 1941, two days before Pearl Harbor, the well had reached a total depth of 8,300 feet and was abandoned because of the outbreak of hostilities. The second well drilled in this area on April 19, 1947, was completed as a dry hole at 9,950 feet by Far Eastern Development Corp. Far Eastern Development was a Philippine corporation headed by Arturo Soriono, a Philippine national who is interested in many lines of business in the young republic.

The company has since been reorgaized as the Philippine Oil Development Co. and is conducting a geophysical survey in the same region near the towns of Tindog, Curva and Medellin. This work was undertaken as a result of encouraging showings in the dry deep test. The company has a lease in this area of 34,000 acres.

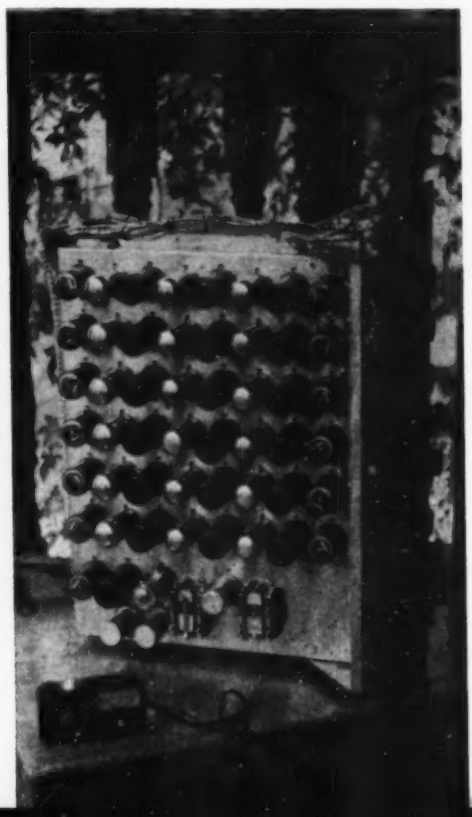
Last October Philippine Oil Development began a wildcat test on Bondoc peninsula in the southern part of Luzon. At latest report this well was drilling at 2,230 feet.

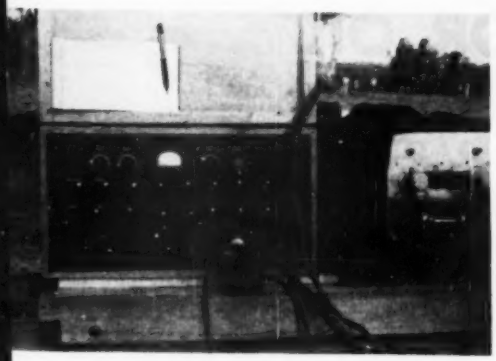
In a paper presented before the Society of Exploration Geophysicists recently, Joshua L. Soske of Geophysical Engineering Corp., Pasadena, Calif., told of some of the difficulties his organization encountered in geophysical exploration work conducted in the Philippines in 1940 and 1941. As is common with other tropical countries, Mr. Soske reported that it is wise in the Philippines to use amplifiers of low gain and low current consumption. All of the equipment should be mildew and fungus proof. Continuing he said:

Seismic equipment to be used in the Philippines must be designed to withstand the prevailing modes of transportation and other types of field treatment. Most of the islands are traversed by at least one hard-surfaced provincial road. However, there are very few branch roads even in the more populated sections of the areas. In the back country there are no branch roads at all. In these parts only foot trails exist which are often too narrow for the use of water buffalo sleds. In these parts of the country the only transportation is by cargadors. Consequently any equipment to be used in the back country must be designed to more or less fit the back of a man. The hazards of this type of transportation are many and demand an adequate supply of repair and replacement parts. Also the design of the equipment must be such that rapid and thorough repairs can be made in the field. Other-

View of seismic station set-up in Philippines by Geophysical Engineering Corporation, Iloilo Province.

Side view of interior of 12-channel amplifiers showing single chassis construction and plug-in features of components.





Close-up view of portable 12-channel amplifiers and recording camera used in Philippines.

| | | | |
|---|---|---|---|
| | CABATUAN FORMATION | SANTA BARBARA SILT 0–500 ft. | Massive gray siltstone containing clays, well preserved molluscs and carbonized wood particles. |
| | | MARAGET SANDSTONE 0–450 ft. | Thin bedded soft ferruginous sandstone grading downward into massive ss. beds containing numerous megafossils. |
| | | BALTIC CLAY 0–100 ft. | Clays similar to Ulion but reported to contain younger fossil fauna. |
| | ULIAN CLAY 0–1300 ft. | | Massive blue clay which weathers to brown, contains carbonaceous streaks and thin beds of fine ss. in lower portion, contains marine fossils. |
| | IDAY FORMATION 0–1500 ft. | | Conglomerate containing sands and carbonaceous clays occurring as beds and lenses, volcanic tuffaceous materials are also present – outcrops as low hogbacks. |
| | DINGLE FORMATION 0–2000 ft. | | Dense to coarsely crystalline, massive limestone containing large solution cavities – occurs as sporatic reefs, made up of corals and molluscs, some places containing interbedded marls, sands and clays. V = 12000 to 13000 ft. per sec. (measured near Pototan) |
| | PASSI FORMATION | UPPER PASSI 800–1300 ft. | Blue clay containing calcareous nodules 1 to 2 ft. in diameter. |
| | | LOWER PASSI 30–100 ft. | Conglomerate containing volcanic boulders measuring up to two feet in diameter. |
| | TARAO FORMATION | UPPER TARAO 350–4000 ft. | Sandstone: fine grain banded by varying amounts of clay, abundant megafossils, carbonaceous streaks and layers common. |
| | | LOWER TARAO 250–2000 ft. | Coarse to fine grained sandstone interbedded claystone containing megafossils. |
| | SINGIT FORMATION | UPPER SINGIT 50–200 ft. | Series of massive sandstones, beds 2 to 20 ft. in thickness separated by carbonaceous seams. |
| | | LOWER SINGIT 200–600 ft. | Conglomerates, massive beds 20 to 300 ft. in thickness containing pebbles to boulders 25 ft. in diameter within a siliceous matrix – cobble materials are basalt and metamorphic rocks – outcrops as rugged hogbacks. |
| | BASEMENT | | Igneous and metamorphic rocks consisting of basaltic flows, breccias, tuffs and porphyritic masses. |

Columnar section Panay (Generalized).

wise much time may be lost in waiting for needed repairs and replacements.

To meet these conditions the Geophysical Engineering Corporation designed light-weight equipment with almost instantly interchangeable parts. Twelve separate channel amplifiers were mounted on a single stainless steel chassis to eliminate weight and size. All of the units were hermetically sealed against humidity and made to plug into one type of socket similar to the one used for the electronic tubes. A transformer or a coupling unit between amplifier stages could be pulled out and replaced in a matter of seconds in exactly the same manner as one changes a radio tube.

Test equipment was constructed so that any component of the equipment could be instantly checked for defects so that very rapid trouble shooting could be accomplished. The design was based on ease of repair and upkeep rather than one to withstand all hazards of the tropics and transportation.

The seismograph amplifiers, exclusive of batteries, weighed 37½ pounds; the camera and supplies make up a package of about 35 pounds; the galvanometers supplied by the William Miller Corporation and the timing mechanism weighed 28 pounds. Four Filipino cargadors could carry these three packages together with the battery and daylight record development equipment. The seismometers and cables were carried by five more Filipinos. In this connection it is worth mentioning that professional Filipino cargadors can carry surprisingly heavy loads astonishingly long distances without apparent fatigue in a climate and in conditions under which an American experiences difficulties going along almost empty-handed. Four more cargadors carried the explosives and shooting equipment.

The shot hole problem was solved by building very light engine-driven equipment after a model supplied by Western Geophysical Company. With minor modifications to make possible the use of local supplies, several sets of this drilling equipment were manufactured in Manila. Each set of equipment under favorable conditions could drill two shot holes ranging from 80 to 100 feet in depth per day. This drilling equipment was either carried by cargadors or hauled on sleds pulled by water buffalo. Where cargadors were used to transport the drilling machinery between shot holes, these same men were placed on a support above the drilling swivel and thus used as a pull-down weight applied to the drill stem.

In the employment of local Filipino workers it is necessary to have a special boss called a capataz with each group as a lead man and as a sort of efficiency expert. Another function of the capataz is to hire local help who can speak his dialect. In the matter of dialect, Filipinos living only five and six kilometers apart experience difficulties with their individual dialects. It is reported that some eight-odd dialects are spoken by Filipinos. These natives are excellent workmen and learn quickly, as long as the tasks remain specialized so as not to introduce an element of confusion. American college-trained Filipino engineers were found to be capable of excellent technical help. They were employed as computers, draftsmen, layout engineers and surveyors.

Last but not of least importance was the problem of the Philippine geological column. Wallace Pratt estimated the total thickness of the Tertiary series of the Island of Panay to be approximately 9,000 meters. To this figure about 1,000 meters of older rocks outcropping near the head waters of the Ulion River may be added, making a total thickness on the order of 32,000 feet.

Over a considerable area of the Iloilo Basin a formation designated locally as the Dingle Limestone either outcrops or seems to be buried at no great depth. The thickness of this limestone is extremely variable, ranging from zero to 2,000 feet. At a point east of the town of Pototan a seismic velocity in this formation was measured approximately 14,000 feet per second. Other formations near the surface in the same vicinity gave velocities on the order of magnitude of 6,000 feet per second, thus making a ratio of approximately one to two.

The surface of this limestone, where observed in the various outcrops, was extremely irregular due to large and various shapes of solution cavities. From a limited amount of refraction studies it appeared that the buried limestone surface was as rough as that of the outcrops.

It was difficult to treat this high-speed bed as any type of geometrical layer because of lenticularity. Where this high-speed formation was buried deep enough to give reflections on the seismograms from top and bottom, attempts were made to make corrections for the presence of this high-speed material in the path of the reflected waves. Certain high energy reflections with high frequency character were correlated as the boundaries of the limestone.

One shortcoming of such a method is that it is based more on assumptions than on factual information, and, as a consequence, the reliability of the final result depends upon the accuracy of the assumption.

The purpose of this reflection seismograph survey was to map geologic structure with the hope of discovering anticlines or other types of closed structures. In the final analysis it was difficult to differentiate whether or not a geophysical high represented a genuine geological structure or simply an indication that a limestone reef may exist underground.

# AERIAL MAPPING FOR OIL

By G. P. Mott, B.A., Assoc. M. Inst. C. E.

**Air survey has reached a stage where it is generally accepted as an essential step in large-scale planning. In recent years it has come to be largely employed by oil companies as a means of enabling geologists to gain the knowledge on which to base detailed findings at far greater speed than any other method yet devised and at economical cost. In 1945 five of the leading air survey companies in the British Commonwealth became associated in the Hunting Group and have carried out aerial surveys for a number of major oil companies in different parts of the world. The author, who is Survey Manager of Hunting Aerosurveys, has been associated with the planning of these undertakings and is a recognized authority on aerial photography—Editor.**

THE rapid discovery and exploitation of new oil fields throughout the world over the past twenty years owes much to the equally rapid advances made in aerial photography and its associated techniques of photo-interpretation and photogrammetric mapping.

Although air survey is now a recognized tool of every petroleum geologist, there still exists a wide divergence of views on the methods of using air photographs as an aid to geological interpretation. Moreover the full potentialities of an air survey are sometimes overlooked through too much concentration on the immediate geological requirements, resulting in failure to appreciate the wider applications of a survey of this nature when carried out with an eye to the future.

The first air photographs were taken nearly a hundred years ago from captive balloons, but it was not until the end of the nineteenth century that the most important innovation took place in the art of surveying from photographs by employing the double image or stereoscopic vision.

Stereoscopic vision differs from natural vision in that images instead of objects are presented to the eyes. If two photographs are taken of the same object but from slightly different angles and presented to the eyes through the medium of a stereoscope, then the left is focussed on objects of detail in one photograph, while the right eye is directed to corresponding objects of detail in the other photograph. The two separate images combine in the brain of the observer to provide a "solid" or three-dimensional view. On this very simple principle depends the whole basis of aerial surveying which has been built up over the past forty years into what is today a highly developed science of far-reaching importance both in war and peace.

Normally when air photographs are used for purposes of mapping and detailed study of the ground, the axis of the camera is directed vertically downward from a hole in the floor of the aircraft. "Vertical" photography of this type takes place in the form of a series of parallel strips, each strip overlapping its neighbor by 30 percent. The shutter speed of the camera is regulated so that successive exposures overlap in the direction of flight by 60 percent. By this means every object on the ground is photographed from at least two different viewpoints of the camera. When two adjacent exposures are examined in a stereoscope, ground features appear to "stand up" in intensified relief. The effect is similar to that gained by a giant whose interocular distance stretches between the two successive positions of the airplane when the camera made the two exposures. Fig. 1 illustrates better than words the relationship between the stereoscopic image and "giant's eye" view.

Air survey has provided the oil geologist with a twofold weapon, the importance of which it would be hard to underrate. On the one hand the photographs themselves, when interpreted by an expert photogeologist, are capable of provid-

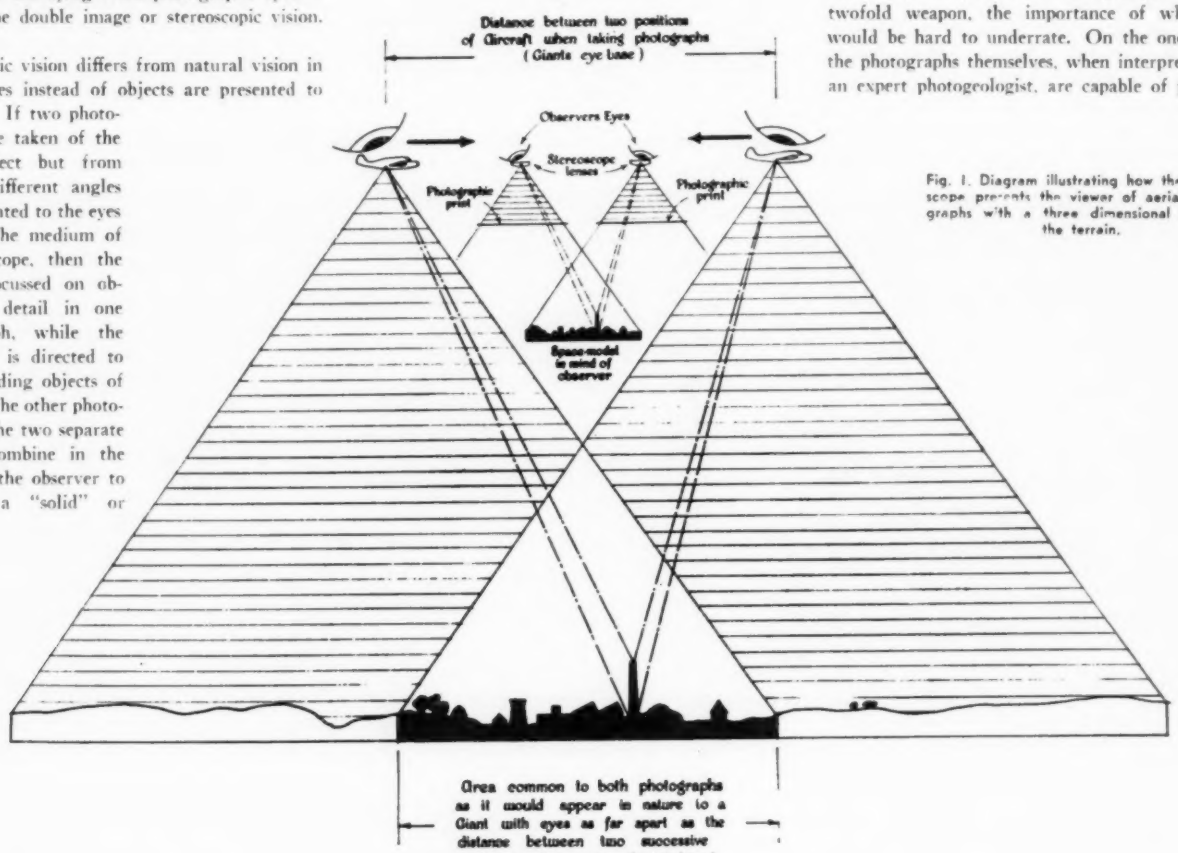

Distance between two positions of Aircraft when taking photographs (Giants eye base)
Observers Eyes
Stereoscope lenses
Photographic print
Photographic print
Space-model in mind of observer
Area common to both photographs as it would appear in nature to a Giant with eyes as far apart as the distance between two successive positions of the aircraft (air-base).

Fig. 1. Diagram illustrating how the stereoscope presents the viewer of aerial photographs with a three dimensional view of the terrain.

Fig. 2. Syenite dyke revealed by change of vegetational tone on the photograph. The dyke does not outcrop and there is no indication of it on the ground.

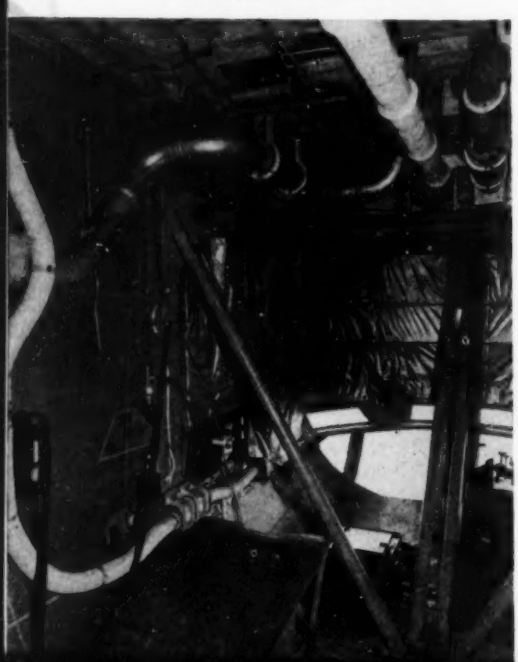
Fig. 3. Vertical air photograph showing the pitching end of a syncline in an alternating series of hard and soft beds. The hard beds which form long dip slopes are almost certainly sandstones. The softer beds which are more rapidly eroded, are silts or marls.

Fig. 4. Bristol freighter specially equipped for high altitude survey. Note navigator's window in nose. This plane photographed 10,000 square miles in one season operating at an altitude above 22,000 feet.

ing an almost limitless source of information, much of which is lost to the observer on the ground. On the other hand, vertical air photographs, provided they are taken with a precision air camera, form the basic material for the production of contoured topographical and even cadastral maps, in which accuracy and wealth of detail are equal, if not superior, to anything that can be executed by the more cumbersome and tedious methods of ground survey.

The simplest of all ways in which the air survey is used by geologists goes by the name of a "mosaic" or photomap, which is nothing more than a composite photographic plan of a large area of country made up of a number of vertical photographs pieced together. Used by itself, a mosaic is of little value, but if interpreted in conjunction with stereoscopic examination of individual pairs of contact prints, it is possible to gain a comprehensive picture of the surface geology over a very wide region. In so doing, conditions that may appear unimportant locally may often assume significance when viewed from a regional standpoint. In a few hours the photogeologist is able to correlate surface features over hundreds of square miles which would take months to cover on the ground. Anticlines, domes, faults, formation contacts, isolated exposures and other geological conditions of importance are manifested through stream patterns, dipping beds, color changes in the soils, or vegetational changes.

Fig. 5. Photo compartment in nose of Bristol freighter showing camera well and camera minder's post. Navigator's compartment is at extreme right.



Certain localities are clearly better suited than others for photogeological survey, but the types of country in which an air survey proves valuable are so varied that the region in which they are unsuccessful is exceptional. In areas of prominent relief the subsurface conditions are frequently reflected in the surface topography, the effect of which is greatly enhanced with the aid of the stereoscope.

Structural "highs" may be identified by radial drainage, pronounced surface relief, dipping strata and the downdip bowing of contacts and beds in the valleys. Salt domes are reflected in many instances by circular or elliptical color changes. Differences in vegetation are often good indications of faults or dikes and are often so slight as to pass unnoticed on the ground.

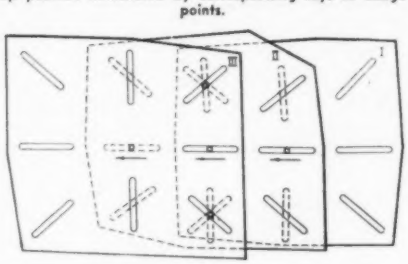
The use of special filters and emulsions further assists in differentiating between different types of rock, soil and vegetation. It is well known, for instance, that infra-red photography will distinguish between coniferous and deciduous trees and can also be used to accentuate the drainage pattern in areas of low relief or to distinguish between land and water along indeterminate coast-lines fringed by gently shelving reefs. The filter most commonly used for aerial photography is the k2 or minus blue, which minimizes the effect of haze and produces true values generally suited to geological and survey requirements.

Other factors influencing the appearance and effectiveness of air photographs include the season of year and time of day when photography is undertaken. As an example, desert photography carried out at midday is liable to suffer from an effect similar to haze due to reflected light off a multitude of small particles of mica or gypsum. Conversely, in mountainous areas, photography at any other time than midday may be rendered less effective by deep shadows that mask details of importance to the geologist. Considerations of this kind necessitate careful planning and carrying out of an air survey program, which can only be done by very close liaison between the geological and survey staffs concerned.

Probably the most important factor in planning an air survey is the scale of the aerial negative. For reconnaissance surveys and general exploration work it is convenient to the photogeologist to have the greatest possible area on a single print. In his initial study of the outcrop pattern it is the regional view and not the detailed structure which is of primary importance. The geological demand is, therefore, for a camera fitted with a lens of the widest possible angle and an aircraft that will fly at an altitude exceeding 20,000 feet.

From the aircrew standpoint, the high small-scale sortie is the most arduous form of survey flying because so frequently it calls for precise navigation along predetermined tracklines over large areas of virtually unmapped country. In some cases the ground itself may be several thousand feet high and the operational ceiling of the aircraft must, therefore, be in the region of 25,000 feet. There are few, if any, civil types of aircraft wtih the necessary range which can fly at this altitude and at the same time are economically and practically suited for survey flying. Moreover, the distortion characteristics of wide-angle lenses, by reason of their construction, cannot give the same accuracy in contoured mapping which is given by lenses or normal an-

Fig. 6. Three slotted templates showing how stud takes up position intersected by corresponding rays of image points.



gular field. For these and other reasons it may often be desirable on practical and economic grounds to accept a larger scale of photography than at first appears best suited for general exploration. Assuming a standard nine by nine-inch negative and a wide-angle lens of six-inch focal length, a contact scale of 1/30,000 will cover in one picture an area of approximately 18 square miles. Photographs at this scale can be taken from 15,000 feet above ground, which is easily attainable by most types of survey aircraft. The same photographs can be used, both for comparatively detailed geological investigation and to provide contoured maps up to scales of six inches to one mile.

The majority of the oil-bearing areas of the world are deserts in the sense that they are unsuited to cultivation on a large scale and, therefore, support only a very meagre native population. Such topographical maps as exist of these areas are usually grossly inaccurate and show so little detail that they do not even meet the needs of the casual traveler; far less do they serve as a basis for geological information. The requirement for new and accurate maps is, therefore, a factor of primary importance in practically every area where oil has been found. Unless the photographs resulting from an air survey are used to provide a topographic survey, much of their value is lost, and there exists no satisfactory basis for recording the data provided, first by photo-interpretation and later by more detailed examination in the field.

The geologist, if he is wise, will not stop at a demand for line maps but will further require the provision of contours that are sufficiently accurate to enable him to determine angles of dip and strike and to construct accurate profiles of the surface structure wherever required. The same maps will also prove invaluable to the field engineer in the development of communications, in locating water supplies and camp sites, in the later construction of pipelines and selection of locations for pumping stations, etc.

Unfortunately there are still many geologists who are content with a make-shift survey based on the barest minimum of control points supplied on the ground and omitting all but the major features of the topograph. Reconnaissance maps of this kind are nearly always more trouble to prepare than those based on an adequate system of control. The value of such maps is limited, and it is considered a poor form of economy which fails to make the fullest use of the information provided by the photographs.

The methods used for turning the raw material provided by the aerial photographs into an accurate topographical map, with or without contours, are many and varied. Where the terrain relief is compared with the height of the aircraft and tilts of the photographs are less than two degees, line mapping (that is, mapping without contours,) is normally carried out by graphical and semi-graphical methods based on the assumption that the angular relationship of image points about the center of the photograph is correct. In this way a graphical triangulation can be built up connecting the centers of a strip of overlapping photographs with selected points of detail in the lateral overlap common to two adjacent strips. Modern technique employs a series of transparent or cardboard templates cut to the size of each photograph, on which the rays from photo-centers to selected image points are represented by slots. The templates are joined together by studs which are inserted in the slots and automatically take up the true position of an image point intersected by the "cut" of corresponding rays from two or more successive templates (Fig. 6). In this way a whole block of templates representing hundreds of square miles of photography can be linked up and scaled between control points fixed on the ground. Fig. 7 shows a large assembly of templates laid down between points of ground control (marked by black triangles) on a specially constructed floor on which is drawn up the map grid or projection. The exact position of the center of each stud is then pricked off on the floor and its coordinate position found from the nearest grid line. In this way a very close system of control is established between which the detail on the photographs can be correctly plotted and turned into a topographic map.

In mountainous country, where the effect of relief rules out the use of a two-dimensional system of plotting, or wherever the requirement is

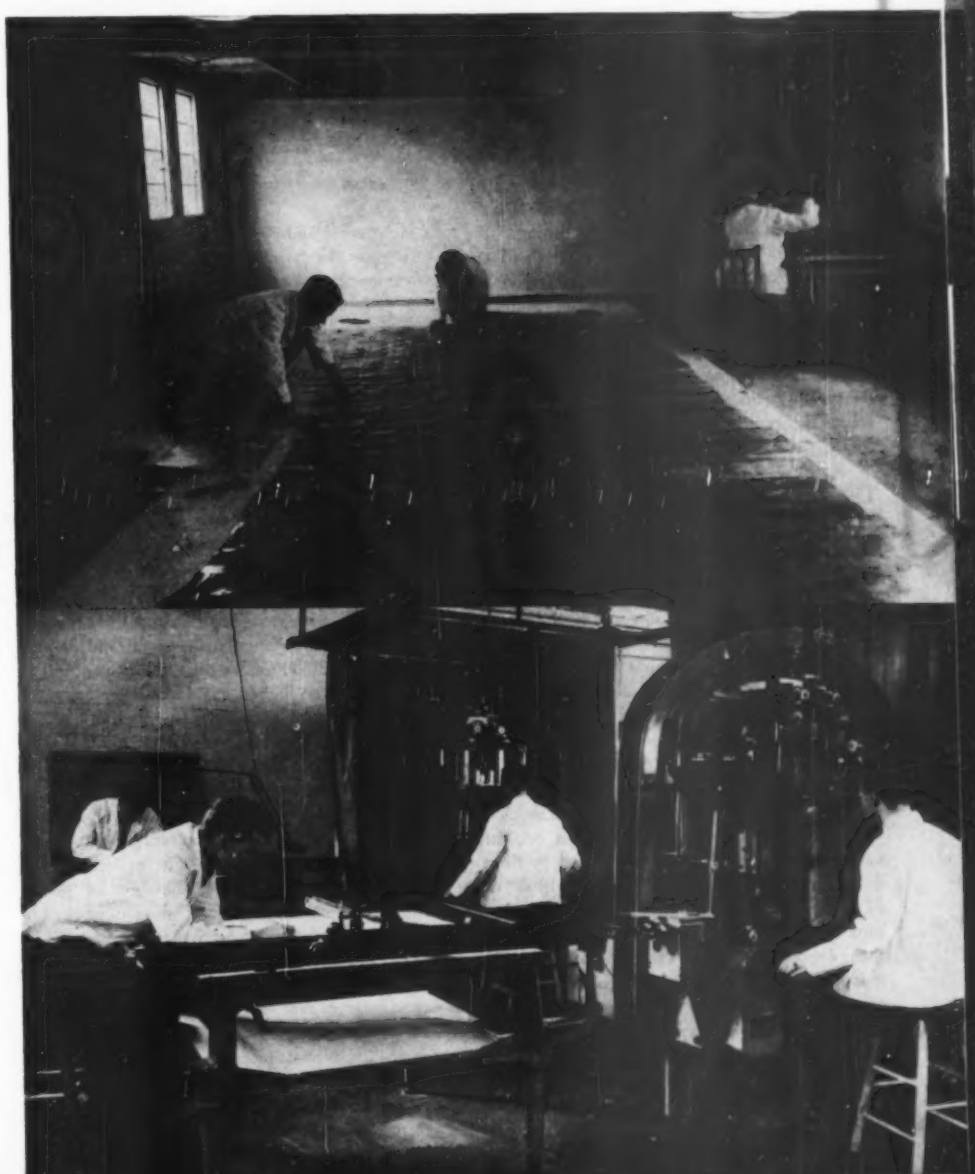


Fig. 7. A slotted template assembly covering an area of some 2,500 square miles on a specially constructed floor on which is plotted the map projection.

Fig. 8. The Wild Autograph A.5 seen in this picture enable stereoscopic pairs of photographs to be correctly oriented in the exact positions they occupied at the moment of exposure. The "space model" so formed provides a correct view of the terrain in three dimensions. Hand and foot operated wheels control the movements of an artificial reference mark contained in the optical system of the instrument which can be made to delineate either objects of detail or lines of equal altitude (contours); meanwhile a pencil on the coordinatograph plotting table automatically follows the motions of the operator and thus traces the map to the required scale and contour interval.

for precise contouring, modern photogrammetric practice employs instruments which reconstruct the geometric conditions of the aerial negative at the moment of exposure in the camera.

The Wild Autograph A.5 shown in Fig. 8 is designed to give the maximum degree of pre cision of any plotting instrument at present in production. It is in fact as remarkable for the simplicity and cleanness of its design as for the unqualified perfection of workmanship put into its construction. From the original film negatives are made glass diapositives, which are inserted, one pair at a time, in the two skeleton cameras of the apparatus. Each skeleton camera is capable of rotation in three directions—fore and aft tilt, lateral tilt, and swing—and can be made to take up an orientation corresponding exactly with that of the photographic camera in the aircraft at the instant of exposure. When this occurs, the stereoscopic image of the landscape, magnified to eight times the photo scale in the binoculars of the instrument, provides a true relief model of that portion of the ground under examination. Two hand-wheels and a foot-wheel control the movements of a reference mark in the shape of a minute black dot, 1/100 m.m. in size, which is contained in the optical system of the instrument. The same operating handles also actuate the movements of a pencil situated on the cross-beam of a coordinatograph plotting table. By setting the height column of the instrument to a particular value by means of a foot-wheel, the floating mark can be moved by the two hand-wheels in a horizontal plane until it appears to touch the side of a slope in the three-dimensional model viewed through the binoculars. When too high, the mark will appear to float above the ground, and when too low, it will split into two separate dots; thus the experienced observer is able to "walk" the dot around the hill so that it just touches the ground all the time. Meanwhile, the pencil at the plotting end of the instrument automatically traces the contour on the plot sheet at the required scale.

There is no method yet devised whereby aerial mapping can be completely divorced from work on the ground, nor is this ever likely to happen. A framework of control points, the height and position of which must be established by normal ground survey with theodolite and level, is essential to the construction of any map, whether it be made from air photographs or not. In aerial surveying the extent and disposition of the framework varies considerably according to the accuracy required of the map and the method used in the plotting. In areas of low relief, where contours are not required, triangulated control points may be separated by as much as 10 to 20 miles and still produce an accurate map. For contoured mapping, however, by three-dimensional plotting instruments, such as the Multiplex or stereoautograph, the number of control points necessary is greatly increased and their disposition is more critical. In some cases it is possible to supplement control given on the ground by a form of "aero-triangulation" carried out in the plotting machine, which reduces the ground work to small pockets of control separated by 10 to 20 miles. For very close-interval contouring, however, the density of control required may amount to one coordinated and heighted point every half mile.

The use of radar and radio aids, both for navigating the aircraft and also as a means of supplying control for small-scale mapping, is now fairly well established. Over large areas the economy in photographic flying by the use of these aids may be considerable, and the position of the aircraft may be established at any time with sufficient accuracy for carrying out small-scale mapping without access to the ground, provided, of course, the positions of the radar beacons themselves are known. The development of radar altimetry has also advanced to the stage where it can be used to provide a network of spot heights which can be used for contouring with a fair degree of accuracy in certain areas.

It must be remembered, however, that such aids are still costly to install and to operate. For this reason their economic use is at present limited mainly to the photography of very large areas and in geophysical prospecting with the aerial magnetometer.

Having provided a brief account of some of the methods and instruments used in photogrammetric mapping, it is worth summarizing the various stages in the search for oil and its subsequent exploitation in which air photogrammetry (in addition to photogeological interpretation) can play a vitally important role.

Here speed and extent of area are the governing factors. In large areas where no triangulation framework exists, it may be necessary to resort to unconnected astronomical fixes or radar fixations. Line-maps (with the addition of rough form-lines to show the general shape of the structure) can be prepared at very great speed and at a cost of as little as 10 shillings ($2.00) per square mile.

One civil air survey company, for which the author can speak, completed over a period of one year the flying and photography, control framework on the ground and the production of line maps at 1/50,000 scale covering 5,000 square miles of territory and employing only a small part of its complement of staff. Given a fair distribution of triangulated control and photography at 1/30,000 scale, this type of map will be well up to the highest standard of accuracy and may be used as a property survey for defining the boundaries of concessional areas as well as a base map to guide the geologist in his field work and on which to correlate all his data.

The result of the regional survey should enable certain areas to be singled out for detailed investigation in which a combination of photo-interpretation, field geology, seismic work and drilling may all play an important part. The same photographs which were used for line mapping and mosaics in the earlier work of reconnaissance can, with the assistance of additional control on the ground and the use of a three-dimensional plotting instrument, such as the stereo-autograph, be turned into precise topographical maps at scales up to six inches to one mile with contours at 20 feet vertical interval. Maps of this nature are ideal for the proper planning of water supplies and communications; they can also be used for "shooting" an area with seismographs, resulting in material savings in dynamite, to say nothing of savings in time.. Photogrammetric mapping gives a greater consistency in accuracy than comparable surveys carried out on the ground and can be carried through in a fraction of the time required for a plane-table survey. A single plotting machine, for example, recently turned out 450 square miles of 1/10,000 survey with 20 foot contours over a period of nine months at an average cost of £20 ($80) per square mile.

Once oil has been discovered, its exploitation and later refining involve vast constructional undertakings, for which large-scale surveys are essential. These can seldom, if ever, be produced by ground methods in time to keep pace with the speed of development. Port facilities, pipelines, pumping stations, refinery plants and housing sites all have to be sited and planned in what may be initially virgin country. Once again air photography and photogrammetric mapping can play an essential part in the production of plans up to scales of 100 feet to the inch with contours, when required, at vertical intervals of five feet.

An interesting demonstration of the advantages of an air survey of this nature has been provided by the contouring of an area of crescent-shaped dunes composed of drifting quicksands that were inaccessible on foot. Below the dunes, the coastline shelved very deeply and offered one of the few possible locations for a port. By photogrammetric methods the contouring of the sand dune area at 10-foot intervals was successfully carried out without so much as setting foot in the area. By this means the engineers were able to make an accurate assessment of the cubic content of sand required to be moved before construction of the port could proceed.

In any development area, such as an oil field or refinery town, where constructional changes are many and rapid, a photogrammetric plan once made can be very rapidly revised and brought up to date from photographs taken at regular intervals, say bi-annually. Furthermore, it should not be forgotten that the air photograph is itself a permanent record of the progress or development at a specific instant of time.

As might be expected, photogeology and photogrammetry have developed into separate sciences, each requiring a special technique. They are, however, both dependent on a common source of material—the air photograph. For this reason no air survey can be fully successful unless the geologist, the engineer and the air surveyor have a full understanding of one another's problems, and share in the planning of the photography. Given this mutual understanding and a wholehearted cooperation, then there is no limit to the assistance which air survey can provide at every phase of petroleum development.

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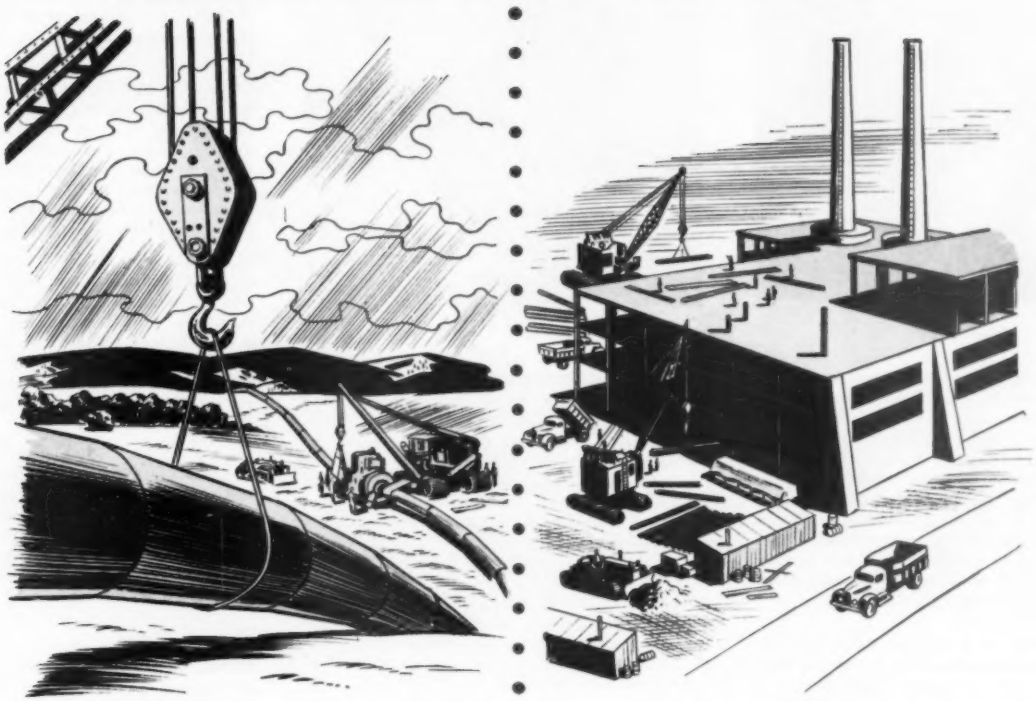

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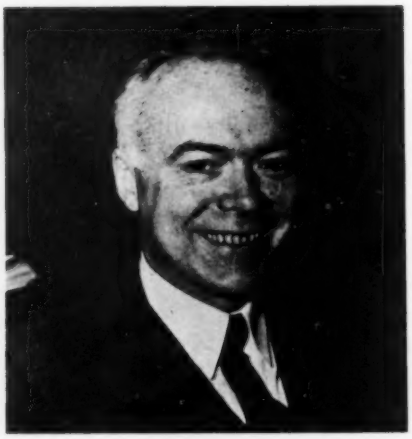
## OIL COMPANY STAFF CHANGES



H. W. Fisher

George T. Tennison

**H. W. FISHER,** a director and general manager of East Coast refineries of Esso Standard Oil Co., has been appointed deputy coordinator of refining activities for Standard Oil Co. (N. J.). Mr. Fisher joined Jersey 21 years ago as a research worker immediately after he was graduated from the Massachusetts Institute of Technology with a degree in chemical engineering. Much of his career has been devoted to the development and production of chemicals from petroleum. In 1945 he was elected a director of Esso Standard and in 1948 was appointed manager of the company's East Coast refineries.

**DR. R. JOHNSON** has been appointed manager of Continental Oil Co.'s manufacturing department, with supervision over the company's eight refineries. Formerly manager of the southern region of the manufacturing department, Mr. Johnson will be succeeded by L. W. Vickery, superintendent of Continental's Ponca City refinery.

Simultaneous announcement was made by Harold G. Osborn, vice president in charge of manufacturing, of the appointment of Charles D. Hull as superintendent of the Ponca City plant. Mr. Hull, who was formerly assistant to the vice president, will be succeeded by C. B. Round, former analyst in the company's coordinating and planning department.

**BETTYE M. BOHANON** has been appointed assistant secretary and assistant treasurer of Conorada Petroleum Corp., recently formed by Continental Oil Co., The Ohio Oil Co., and Amerada Petroleum Corp., for the purpose of foreign oil exploration. Miss Bohanon comes to the company with almost 19 years of experience in the oil industry. During the war she was on the PAW staff as a production and priorities specialist. She was an assistant petroleum attache with the State Department at Lima, Peru, from 1944 to 1946. After her return to the United States she joined the Washington office of the American Independent Oil Co.

**J. W. LIDDELL,** Continental Oil Co.'s eastern sales manager, New York, has been appointed general manager of company operations in the eastern region with headquarters in New York. His appointment was effective Feb. 1. He will be succeeded as eastern sales manager in New York City by J. R. Cunningham, who is at present southern sale manager with headquarters in Fort Worth. L. R. Kump, now division marketing manager at Salt Lake City, will succeed Mr. Cunningham.

**GEORGE T. TENNISON** has been named regional gas manager to coordinate the gas activities of Shell Oil Company's four areas east of the Rocky Mountains. Mr. Tennison joined Shell in 1937 as gas contract representative at Shell's Tulsa area office. In 1946 he became assistant to the regional director of the gas-gasoline department at Houston. In his new duties he will be assisted by Ed S. Quinn, coordinating gas contracts and measurements; and by John B. Haefer, Jr., handling purchases and sales of volatiles.

**WAYNE C. YEAGER** retired on Feb. 1 as vice president of Atlantic Refining Co. after having served the company for nearly 53 years. Starting as an office boy in 1896, he was made assistant to the chief clerk a few years later and in 1903 was made manager in Easton, Pa. A succession of managerial positions took him finally to vice president and general manager of domestic sales in 1935. He had been made a director of the company in 1930 and was elevated in 1947 to the general management of all sales.

**CHARLES M. RIDGWAY** of Chicago, has been named to the new post of manager of The Pure Oil Co.'s research and development laboratories. William B. Ross continues in the position of director of research of the research and development laboratories. Mr. Ridgway has been with Pure Oil since 1932 and recently has been technical assistant for the refining division.

Charles M. Ridgway

**DR. H. G. BURKS, JR.,** has been elected a vice president of Esso Standard Oil Co. to succeed J. R. Carringer as contact director for the manufacturing, supply and transportation, and chemical products departments. Mr. Carringer will retire on May 1 after 45 years' service. M. W. Boyer, vice president and director in charge of Louisiana manufacturing operations, will assume Dr. Burk's former position as director of all manufacturing operations for the company. Cecil Morgan, associate general counsel in the law department, was elected a vice president and will head Louisiana manufacturing operations and crude oil purchasing. W. F. Thiede was appointed manager of East Coast manufacturing operations and P. E. Kuhl as assistant manager.

**EDGAR R. LOCKE** has been appointed manager of the exploration department, Mid-Continent Petroleum Corp., Tulsa. He will take charge of all geological and geophysical operations for the company, with G. N. Smith and A. L. Beekly remaining as chief geophysicist and chief geologist, respectively. Mr. Locke has been in charge of geophysical operations in the Rocky Mountain area for The Texas Co.

**S. J. MEISENBURG** has been appointed superintendent of Shell Oil Co.'s Wilmington, Calif., refinery. He succeeds L. R. Goldsmith who has been transferred to New York for assignment in the economic development department. Mr. Meisenburg has been with Shell since 1935, serving in various refineries and most recently as assistant manager of research and development at New York.

**LYNN R. STRAWN,** formerly of The Texas Co., at Port Arthur, has been appointed manager of the Neches plant of Jefferson Chemical Co., Inc. Mr. Strawn has been with The Texas Co. since 1932. He was in charge of process engineering in light oil and lubricating oil manufacturing and gas processing. His appointment results from the transfer of A. A. Triska, previous plant manager, to New York.

**MERLE R. CHURCH** has been appointed regional gas engineer of Shell Oil Co., at Houston, Texas. He will deal with the construction of plants. The technological section of the engineering section of Shell's regional production department is headed by John T. Jordan, regional technologist, who will deal with the design of such plants

**E. R. WAGNER** has been named plant superintendent of Stanolind Oil and Gas Co.'s new Slaughter natural gasoline plant near Levelland, Texas. Slaughter plant will process 90 million cubic feet of gas and produce 80,000 gallons of gasoline and 100,000 gallons of butane and propane each day. Completion is expected in March.

Wm. B. Ross

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# International News and Notes

Fred H. Billups

**FRED H. BILLUPS** has been appointed assistant marketing coordinator of Standard Oil Co. (N. J.) He has been marketing advisor for Europe and North Africa since March 1947. He will act in a similar capacity for all company affiliates in the eastern hemisphere as well as Central and South America. Mr. Billups began his service with the company in 1928 at an Esso service station in his native city of Norfolk, Va., upon graduation from Virginia Polytechnic Institute.

At the same time the company announced these other appointments: George M. Parker, marketing advisor for European and North African affiliates, and R. R. McCoy, deputy advisor; D. W. Ramsey, marketing advisor to Central and South America, and W. A. Greeven, deputy advisor; William R. Maddux, shareholder's representative for Germany.

## Harold Moore in South Africa

Harold Moore has recently arrived in South Africa and taken charge of Harold Moore & Partners (Pty.) Ltd., South African affiliate of the companies now directed by Mr. Moore and Mr. Charlton. Mr. Moore is consultant to and managing director of Union Petroleum Refinery (Pty.) Ltd., which proposes to construct a petroleum refinery in the Union of South Africa.

In addition to the South African company, the Moore & Charlton interests include Harold Moore & Partners (Engineers) Ltd., specializing in the design and construction of petroleum refineries, with headquarters at Research Laboratories, Godstone Road, Whyteleafe, Surrey, under the management of B. N. Darbyshire. Another affiliate is Moore, Charlton & Associates, Inc., 1 Atlantic Street, Stamford, Conn., USA., of which Philip H. Moore is the president.

At the present time Mr. Charlton is principally engaged by Petrocarbon, Ltd., as their engineer-in-chief and consultant on the construction of the Petrochemical plant at Partington, near Manchester. The group is also interested in the northeast coast refinery project of Trent Oil Products Development Co., Ltd., and is in charge of the extensions of the S.A.C.O.R. refinery in Lisbon.

## G. A. Johnson Retires

George A. Johnson, Standard-Vacuum Oil Company's area manager for India, Pakistan, Burma and Ceylon, retired Feb. 1 after 37 years' service. A petroleum marketer in India for 18 years, Mr. Johnson was manager of the company's office at Karachi during World War I and at Bombay until 1922. He then joined the executive staff of the company's India division headquarters at Calcutta, returning to New York in 1930 to direct the sales activities of the entire division. At the beginning of World War II he went back to India to help organize and direct Standard-Vacuum's activities in connection with the wartime petroleum supply for Allied military forces in the China-Burma-India theatre.

## Shell Appointments

I. D. Davidson, managing director of Cia Mexicana de Petroleo El Aguila S. A., is returning to London to become manager of the production department of the Shell group of companies. Mr. Davidson joined Shell in London in January 1921 and served in the fuel oil general department. He went to Mexico in 1935 as an assistant to the managing director, and became joint managing director in 1946 and president and managing director in 1939.

Robert E. Kepke

**ROBERT E. KEPKE**, vice president of The British-American Oil Producing Co. and The Toronto Pipe Line Co., has been transferred to Toronto, Canada, as vice president of The British-American Oil Co., Ltd., in charge of the newly created department of supply and transportation. He will have charge of the purchasing of all crude oil and its transportation. This includes purchasing in the United States, Canada, South America and the Middle East.

## Honored by France

A. E. Sawdy, managing director of London & Thames Haven Oil Wharves, Ltd., and a director of Cie. Industrielle Maritime of Le Havre, has been nominated a Chevalier of the Legion of Honor. This is in recognition of his work in the reconstruction of the oil installations at La Havre and at Gennevilliers, Paris.

## More Tapline Pipe Released

Release of 25,000 tons of 30-inch steel pipe for export to Saudi Arabia late in February gives indication that the Trans-Arabian Pipeline Co. now will be able to complete its projected line to the Mediterranean. The export license was the first granted by the Department of Commerce to Tapline since last April and brings the total released to 79,000 tons. An additional 181,000 tons of pipe will be required to complete the 1,067-mile line. Pipe now released has been manufactured and is in storage ready for shipment.

Secretary of Commerce Charles Sawyer obtained an agreement from Tapline to transport U. S. Navy oil from the Persian Gulf to the Mediterranean at cost. Over a 10-year period this is estimated to save the Government about $2 million. The Navy has an option to purchase considerable volumes of oil from Saudi Arabia, part of which will be required in European waters and part in the Orient.

## Open Office at Edmonton

O. W. Morgan, Jr., general sales manager of Byron Jackson Co., and John B. Merritt, assistant general manager of Patterson-Ballagh, division of Byron Jackson Co., have recently returned from an extensive trip in Canada. Their observation of the vast drilling development around Calgary and Edmonton has necessitated a sales engineer being placed at Edmonton. Shortly after the first of April the Byron Jackson and Patterson-Ballagh sales engineer will be available better to serve the expanding Canadian oil fields.

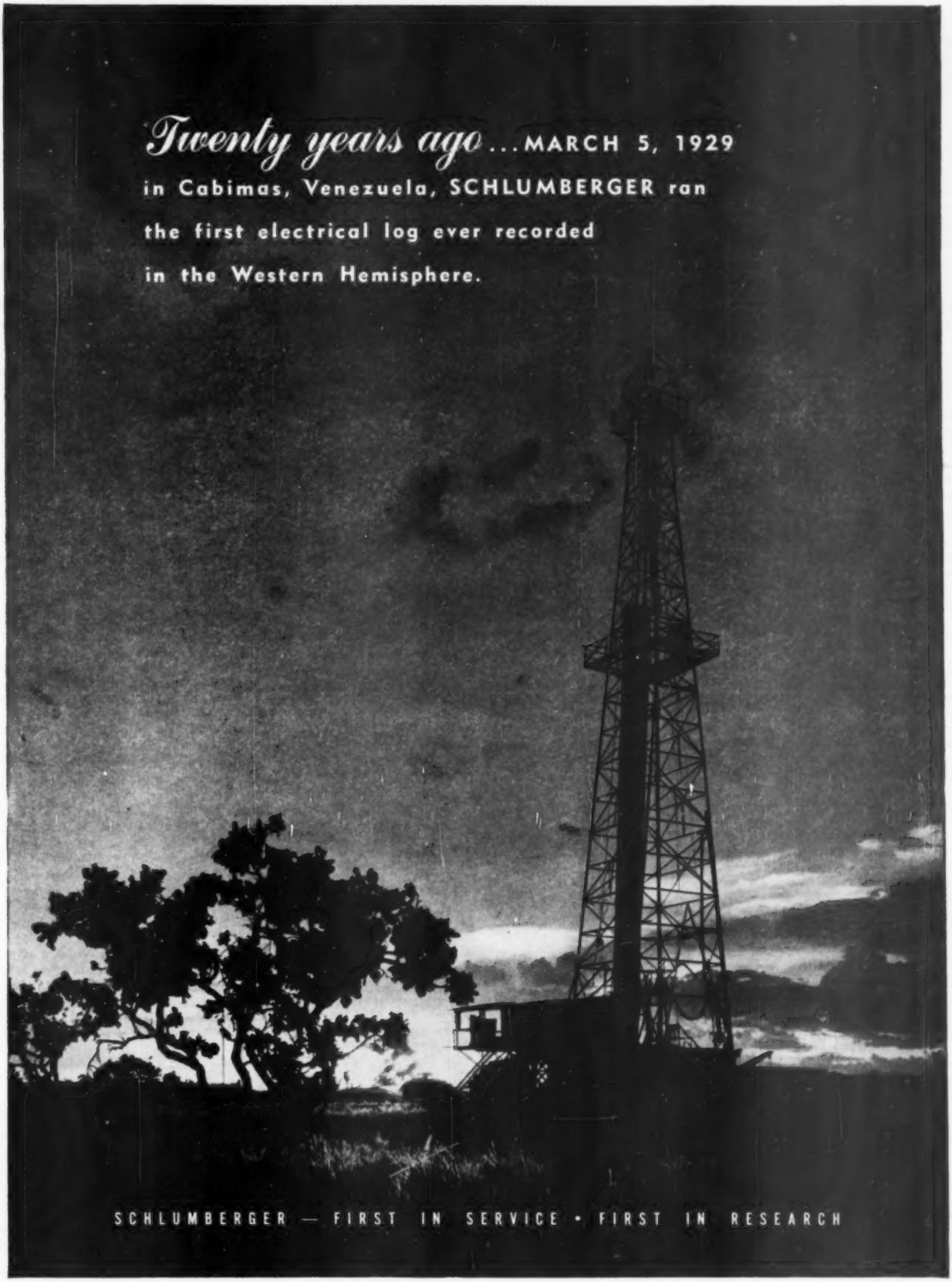
**DONALD A. BRACKEN** retired in February to private life after devoting almost 28 years to the petroleum industry in South America. He started working for the Tropical Oil Company in Barranca Bermeja, Colombia, in July of 1920 and remained with that company until January 1926. The following November he accepted a position with the Mene Grande Oil Company in Venezuela, remaining with them over 22 years, or until February of the current year. During the first 11 years of this period, he served in the company's accounting department in Maracaibo and was then transferred to eastern Venezuela. After a four-year stint as head of the accounting department in Ciudad Bolivar followed by a year in San Tomé, he became an executive assistant for Mene Grande in Caracas and acted as director of industrial relations and personnel. Mr. Bracken is a native of Pittsburgh, Pa., was an air force sergeant in World War I. He will retire in or near Albuquerque, N. M.

## Heads Export Sales

General Harlan L. Mumma, U. S. A., retired, has been appointed world export manager of Black, Sivalls & Bryson, Inc., with headquarters at 30 Rockefeller Plaza, New York City. General Mumma recently returned from a tour of industrial centers in several South American countries following his retirement from the Army after 36 years of active service. Earl Ruth, formerly sales engineer in the Kansas City executive offices, has been appointed to General Mumma's staff as consulting engineer.

In addition to oil field equipment which has made up the bulk of the company's export trade in the past, propane tanks will be offered to the rapidly growing LP gas industry in South America.

Gen. Harlan L. Mumma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## Ecuador Grants Huge Concession

On December 20 the Ecuadorean government, with approval of Congress, signed an important contract with the Shell Co. of Ecuador, Ltd., and the Esso Standard Oil Co. (Ecuador) S. A., providing for the exploration and exploitation of a concession of 4,776,-110 hectares of almost 12 million acres east of the Ecuadorean Andes in the Oriente. The exploration period is for five years with a possible prolongation for further three years. The exploitation period is 40 years with a guaranteed extension of 10 years more. After 38 years the concessionaires may retail 400,000 hectares or roughly one million acres. Surface taxes amount to 500,000 sucres yearly for the first five years and one million sucres ($36,000) for the following years. In addition a guaranty of one million sucres or bonds has to be deposited. The royalty is based on a sliding scale, according to the distance from the port of embarkation on the Pacific Ocean. Royalty is payable in cash or in kind on net clean oil with the provision whereby the commercial value shall be fixed mutually by the concessionaires and the government, depending on the commercial value of a crude similar in quality and characteristics in a mutually selected world market. The royalty for natural gasoline is six percent for the first 20 years and eight percent thereafter. No special taxes nor export imposts will be charged with the exception of the income tax. The Ecuadorean government agrees that this income tax shall be paid either on the basis of eight percent of net profits per year without taking into account amortization of the capital required for exploration; or on the basis of the ordinary rate of income tax generally applicable to mining companies but which in no case may exceed the rate of income tax applicable to industrial enterprises in general. If income tax is paid at the ordinary rate, allowance for amortization of capital required for exploration is taken into account.

An average of 30 million sucres yearly, about 2.2 million dollars, has to be spent by the contracting companies from the beginning of the exploitation period until commercial production has been reached and conveyed by pipeline to an Ecuadorean seaport. All necessary equipment can be imported free of duty. This privilege applies during the exploratory period, during its optional extension and for the first 20 years of the exploitation period.

This contract, in which Shell and Esso Standard (Ecuador) share equally, means one of the most important undertakings in the development of South American oil resources and is the first step toward large-scale exploration of the oil-bearing belt east of the Andes in the Amazonian jungle. Prior exploratory wells in Vuano and Ayuy have been drilled by the Shell Co. in the Ecuadorean Oriente, and extensive preliminary studies have been made by several major oil companies in the Montaña of Peru, but further development in that country has been handicapped so far by delay in the adoption of a new oil law.

## Britain Keeps Pool Petrol

Although all the old brand names are back on the service station signposts in Britain, the return of branded petrol is being delayed at the request of the Ministry of Fuel and Power. The difficulties which would attend the ending of the pool petrol system and the return of branded petrol to the pumps are such that the ministry does not desire the change.

It was agreed last year, when the Petroleum Board was disbanded, that no branded petrol should be allowed before the beginning of 1949. This further delay is attributed to high cost, loss in petrol through octane competition and the additional problems of distribution.

## Venezuelan Production

Production of crude oil in Venezuela during the month of December 1948 amounted to 42,364,677 barrels, an average of 1,366,602 barrels daily. As compared with November, this daily average is higher by 4,622 barrels. Exports for the month amounted to 36,498,197 barrels. Production by companies for the month of December and for the entire year 1948 is shown in the following tables:

**Industry Production by Operator December 1948**

| Company | West | East | Total |
|---|---|---|---|
| Creole | 14,432,213 | 4,507,566 | 18,939,779 |
| Mene Grande | 1,989,815 | 5,084,092 | 7,073,907 |
| Shell | 13,656,891 | — | 13,656,891 |
| Sinclair | — | 524,410 | 524,410 |
| Socony | — | 968,421 | 968,421 |
| Texas | — | 315,190 | 315,190 |
| S. A. P. Las Mercedes | — | 431,331 | 431,331 |
| B. C. O. | 37,573 | — | 37,573 |
| Phillips | — | 58,707 | 58,707 |
| Rexco | 42,645 | — | 42,645 |
| Atlantic | — | 315,823 | 315,823 |
| Total Barrels | 30,159,137 | 12,205,540 | 42,364,677 |

The 1948 total of 489,986,000 barrels, given in the following table, shows an increase of 55,346,000 barrels over the 1947 total of 434,640,000 barrels.

**Industry Production by Operator Year 1948**

| Company | West | East | Total |
|---|---|---|---|
| Creole | 175,815,571 | 57,492,434 | 233,308,005 |
| Mene Grande | 22,021,424 | 57,703,024 | 79,724,448 |
| Shell | 151,073,884 | — | 151,073,884 |
| Sinclair | — | 6,759,625 | 6,759,625 |
| Socony | — | 11,137,257 | 11,137,257 |
| Texas | — | 2,891,397 | 2,891,397 |
| S. A. P. Las Mercedes | — | 2,544,523 | 2,544,523 |
| B. C. O. | 406,408 | — | 406,408 |
| Phillips | — | 653,675 | 653,675 |
| Rexco | 279,996 | — | 279,996 |
| Atlantic | — | 1,116,295 | 1,116,295 |
| Orinoco | 90,120* | — | 90,120 |
| Total Barrels | 349,687,403 | 140,298,230 | 489,985,633 |

* Produced by Netick field under Orinoco Oil Co., operated through October 1948; now is included in Mene Grande Oil Co.

## On Foreign Fields Trip

R. B. Paddock, service engineer of Technical Oil Tool Corp., Ltd., left New York early in February to visit oil company offices in Europe and all of the oil fields of the Near, Middle and Far East. The trip is expected to require eight months.

## Saudi Arabian Production

Crude oil production in Saudi Arabia during January amounted to 16,240,352 barrels or an average of 523,-882 barrels per calendar day. Production on adjacent Bahrein Island was 944,195 barrels or 30,458 barrels daily.

## Leduc Gasoline Plant

Plans to construct a gas gathering system, compressor station and gasoline plant in the Leduc oil field at an estimated cost of $6,500,000 have been completed, with the work of erection scheduled to start in the spring, W. L. Taylor, manager of the western producing operations for Imperial Oil Ltd., announced. The plant will have a capacity of 24,000,000 cubic feet per day and will recover propane, butane and natural gasoline. Completion of the plant is expected to be mid-summer, 1950. The contract for the erection of the plant has been let to C. F. Braun and Co., California.

**FRED A. DAVIES** has been elected executive vice president of Arabian American Oil Co. and a vice president of Trans-Arabian Pipe Line Company. He will assist President W. F. Moore in the direction of all phases of the company's operations. He has been associated with Aramco since the earliest days of the company's activities in the Persian Gulf area. A mining engineer and oil geologist by profession, he was among the first to suspect the presence of oil in Saudi Arabia. Since 1947 he has concentrated on an expanded production and exploration program as vice president in charge of those departments.

**STANOLIND OIL AND GAS CO.** has created the position of division exploration superintendent in its Canadian and Colombian divisions. Announcement was made by C. T. Jones, manager of Stanolind's foreign exploration department. Named to the new posts were G. T. Buskirk, formerly division geologist at Bogota, Colombia, and C. F. Scholck, formerly division landman at Calgary, Alberta, Canada. Each will remain in charge of the Stanolind office at his location. Ian M. Cook has been named a senior geologist at Calgary.

## Flexibox Limited Moves

Flexibox Limited, mechanical engineers and manufacturers of Flexibox mechanical seals for rotary pumps and compressors, have recently moved to their new and larger works and offices in Nash Road, Trafford Park, Manchester 17, England, about quarter of a mile from the previous location. Since the company was formed in 1945, the increasing demand for mechanical seals has made it necessary for Flexibox Limited to acquire larger premises.

**K. A. ROBERTSON** has been appointed vice president of the United Geophysical Co., of Canada, and will make his headquarters in Calgary, Alberta. He also is area supervisor of the Canadian and Rocky Mountain division of the United Geophysical Co. Mr. Robertson will move his family from Tulsa to Calgary. Wayne A. Phares has been appointed area supervisor in Canada for gravity operations.

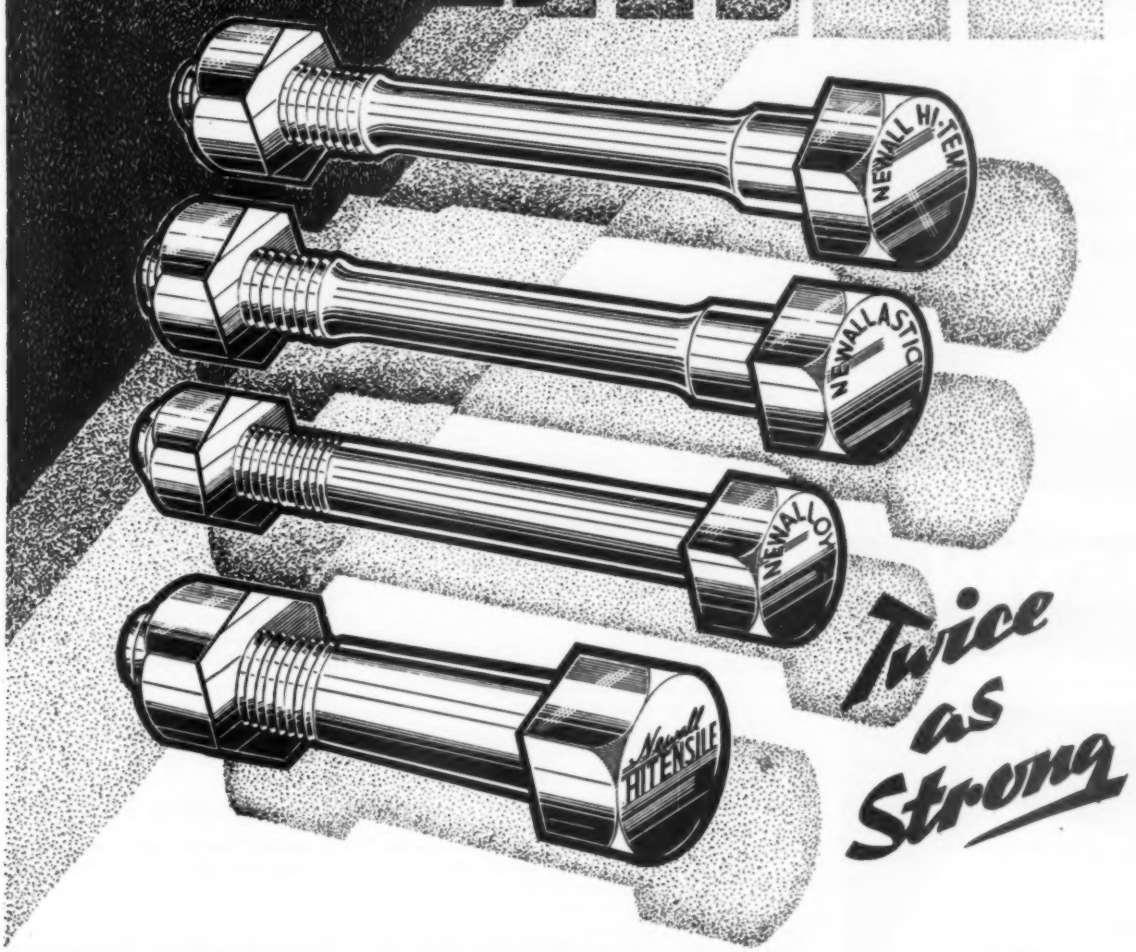
**J. M. COOPER**, assistant superintendent of production for Gulf Oil Corp., Houston, has been appointed assistant managing director of Kuwait Oil Co. Mr. Cooper's headquarters wil be in London. He has been an employee of Gulf since 1923. He was made chief production engineer of the Houston district in 1945.

## Colombian Production

Crude oil production in Colombia totaled 24,371,262 barrels in 1948, an average of 66,771 barrels daily. This compares with 70,415 barrels daily in 1947 and 63,320 barrels daily in 1946. The 1948 drop was largely caused by an oil-field strike. Current output is averaging 82,400 barrels daily. Production by companies in barrels in 1948 follows:

| | Crude | Condensate |
|---|---|---|
| Tropical | 9,094,225 | 578,797 |
| Colombian Petroleum | 8,003,215 | — |
| Condor (Shell) | 6,256,611 | — |
| Valle del Magdalena (Socony) | 389,509 | — |
| Texas | 48,905 | — |

# NEWALL

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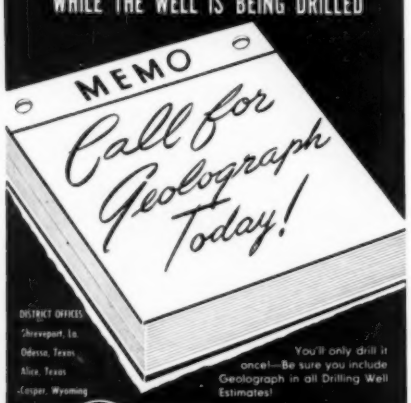


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F. R. Yost

**F. R. YOST** has been named to the newly-created post of manager of the producing department of Stanolind Oil and Gas Company. He started in the oil business with the Yount-Lee Oil Company in 1934 and joined Stanolind the following year, when it purchased most of the Yount-Lee properties. He has worked as driller, tool pusher and field superintendent and in 1945 was made drilling superintendent in the producing department. Since Jan. 1, 1947, he has been operating superintendent.

Frank Lindeman, Jr., has been made operating superintendent, succeeding Mr. Yost. Since last August Mr. Lindeman has been assistant division production superintendent for the Texas-Louisiana Gulf Coast division in charge of Stanolind's offshore operations in the Gulf of Mexico. He is a graduate of Colorado School of Mines. He joined Stanolind in 1933 and has been with the company continuously except for nearly four years spent in war service with the field artillery, in which he attained the rank of Lieutenant-Colonel.

**H. J. STRUTH**, oil economist and analyst has joined the staff of the American Petroleum Institute in New York as head of the research section in the department of information. He resigned the editorship of the Petroleum Data Book to accept the position with the API. Mr. Struth has been in the petroleum industry for 31 years. He spent 10 years with the Mid-Continent Oil and Gas Association as an economist and administrative assistant. During the NRA days he served in Washington as technical adviser to the Petroleum Administration.

## TCC Unit on Stream

Continental Oil Company has completed a two-month test run of the new TCC catalytic cracking unit at its Denver, Colorado, refinery. Designed to operate at a fresh feed reactor charge rate of 3,300 barrels daily, the unit has a one-to-one internal recycle ratio to provide maximum flexibility with respect to gasoline and fuel oil production. Capacity rating of the unit is 6,600 barrels daily. The Denver unit is the first cat cracker in the State of Colorado; however, it is the fourth TCC for Continental, three others of larger capacity having been operating in the company's Ponca City refinery since early 1944. The Denver unit is the 69th catalytic cracking unit to be licensed by Houdry Process Corp.

## Sells Extrulite Core Tubes

Extrulite core tubes for protecting, storing and transporting conventional oil well cores are now available in the Mid-Continent and Rocky Mountain branches of the Reed Roller Bit Co. These lightweight core tubes provide geologists and engineers with a new method of handling oil well cores. The possibility of mixing or reversing samples has been eliminated by inserting all pertinent data on a label which is readily visible from the outside of the tube. As the cap that is sealed at the well is red, correct orientation of the sample is assured at all times. The other end is clear and factory sealed.

## To Build Gasoline Plant

A natural gasoline plant to process casinghead gas produced in the Chico field of Wise County, Texas, will be erected by Cities Service Oil Co. Present plans call for an eventual processing capacity of 22 million cubic feet of gas daily and the installation of five 600-horsepower units. Completion of the first step in the total program is scheduled sometime late this year.

## Hexadecene Available

Houdry Process Corp., has announced availability in research quantities of hexadecene, a moderately priced olefin raw material which has interesting possibilities in organic syntheses. Besides its utilization in numerous olefin reactions, hexadecene should be of interest because of some of its physical properties given below: boiling point, 242°C.; pour point, less than —50°C.; flash point, 90°C.; viscosity: at 38°C, 3.57 centistokes; at 54°C., 2.57 centistokes; at 99°C., 1.33 centistokes.


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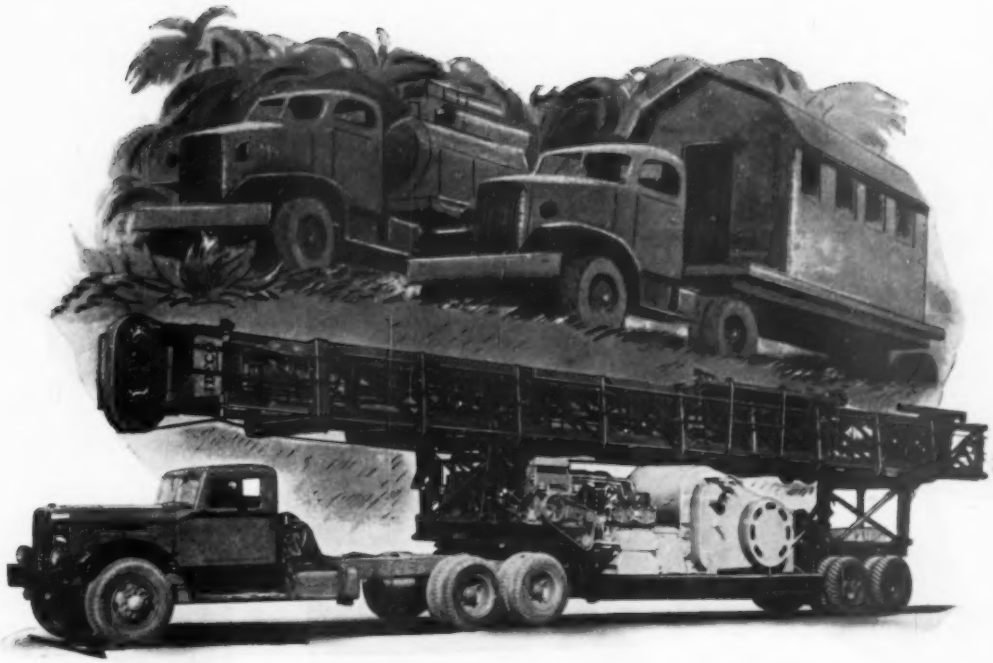

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## Nuclear Fission in Automotive Tests

At its Richmond, Calif., laboratories, California Research Corp., Standard Oil of California's research organization, is using a revolutionary research method involving the use of radioactive automotive parts in test engines. Its objective is longer engine life and less expenditure for automotive repair, as well as more economical automobile operation.

In the new test method the company has worked closely with the Atomic Energy Commission, using piston rings which have been suitably activated in an atomic pile at the Oak Ridge National Laboratory. This peacetime application of nuclear fission to modern industry has enabled the research engineers to run fuel and lubricant tests in a much shorter time than present methods permit.

In beginning a typical fuel or lubricant test, a radioactive piston ring, for example, is taken from its 300-pound lead safety box and carefully placed on the test engine's piston. Then, after three or four hours of operation, a sample of oil is taken from the engine's crankcase. The oil is tested with a delicate Geiger counter which immediately indicates the amount of metal worn from the activated ring—minute particles of iron flushed away by the oil.

With radioactive rings in a test engine, the amount of wear can be measured so closely that as little as one-millionth of an ounce of metal worn from the rings can be detected.

Two other oil industry uses of radioactive substances also were revealed by the research corporation. One involves the tracing of oil shipments through miles of pipeline, which is accomplished by placing one billionth of an ounce of radioactive barium in an oil sample, and then following the sample's progress with a Geiger counter. In this way it becomes possible to separate more accurately the many types of crude oil or products which flow one behind the other through a given line.

Another application is that of radioactive carbon, which is used in much the same way to learn more about what happens to gasoline molecules as they pass through the complex operation of a modern refinery. It is expected that this new scientific tool will contribute to the steady improvement in methods of producing better petroleum fuels and in the more efficient use of the nation's oil resources.

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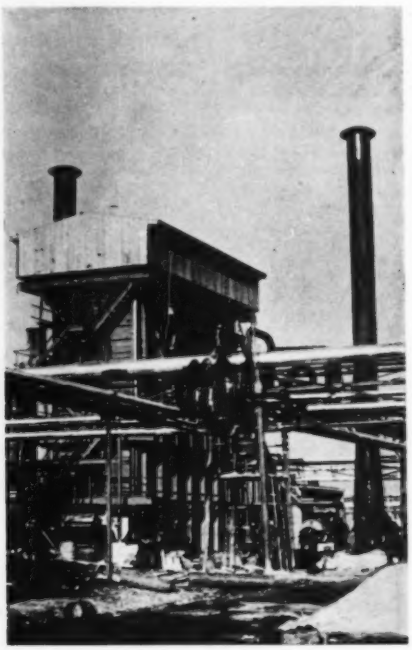

Petrochemicals plant at Partington.

## Petrochemicals Ltd. Opens First Furnace

Operation of the first cracking furnace of Petrochemicals, Ltd., for producing chemicals from petroleum began early in February in the plant at Partington, near Manchester, England. The cracking furnaces transform the charging stock—a petroleum distillate—into liquids and gases which are processed in subsequent plants to yield finished chemicals. The £4½ million all-British plant employs the Catarole process, an invention originated and developed in Great Britain, which makes possible the production of over 70 different chemicals from the liquids and gases derived from petroleum. Among these are raw materials for paints and varnishes, rubber and plastic products, dyestuffs, detergents, drugs, anesthetics, pharmaceuticals, special fuels and numerous others. A number of the chemicals have never before been available in Britain in bulk.

## Aramco Moves Offices

The Arabian American Oil Co. will move its executive offices and certain departments of the company from San Francisco to New York where a new 21-story office building at 505 Park Avenue has been leased. New York offices now housed at three widely separated locations, as well as the departments being moved from San Francisco, will be consolidated under one roof. The initial move from San Francisco contemplates the transfer of approximately 200 employees during May and June. Studies are continuing as to the advisability of consolidating the entire San Francisco and New York organization.

Erecting Petrol Storage Tank in Iraq.

Handling General Stores

Oil Pipe Lines being lifted into position.

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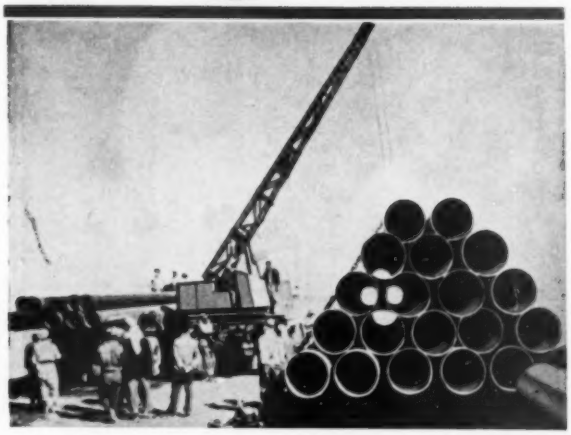

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Gen. David N. Hauseman

## Elected To Trust Company Board

General David N. Hauseman, president of the Houdry Corp. and chairman of the board of Catalytic Construction Co., Houdry subsidiary, has been elected to the board of managers of Girard Trust Co. He is also a trustee of Temple University and a director of the Research Institute of that university. General Hauseman retired from the United States Army on his own application after thirty years' service. He has been awarded both the Legion of Merit and the Distinguished Service Medal.

## G. Harrison Smith Dies

A figure long prominent in the international oil industry passed from the scene with the death of G. Harrison Smith, which took place at Miami, Fla., on Feb. 17. Mr. Smith was born in Brooklyn, N. Y., in 1879. Upon leaving school he found employment with the original Standard Oil Company as an office boy at $5 per week. As he rose in the company he became identified with its foreign operations and became vice president of West India Oil Company and Standard of Brazil. In 1914 he joined Imperial Oil Ltd., Canadian affiliate of Standard, later becoming president of that company and of International Oil Company with large producing properties in South America. He also was a director of Standard Oil Company (N. J.), General Electric Co., Royal Bank of Canada and Imperial Life Insurance Co.

Mr. Smith was active in the handling of petroleum affairs for Canada in both world wars. He retired from active business in 1945.

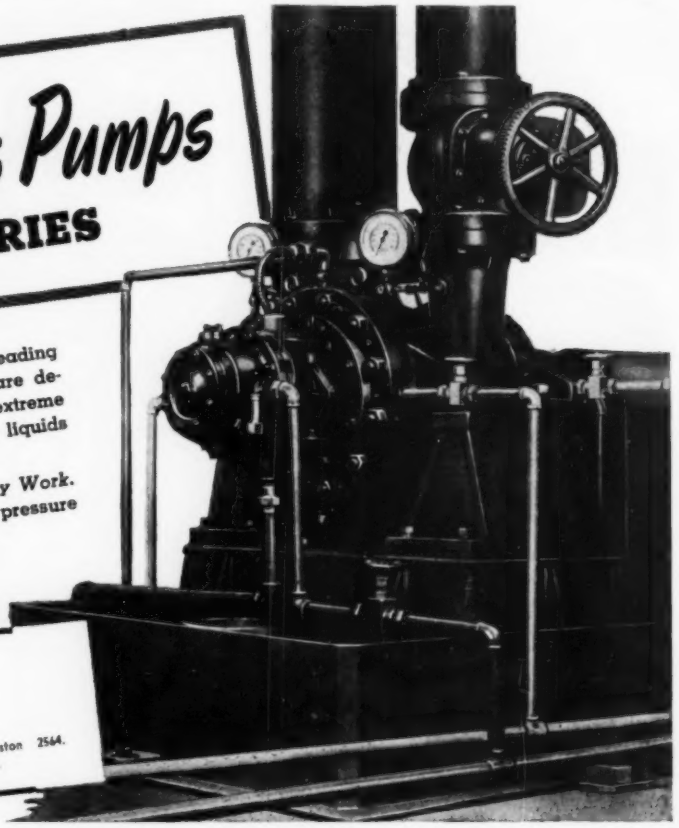
## Poulter Demonstration

The first international tests of the new Poulter seismic exploration method were conducted recently at the request of Petroleos Mexicanos, south of Reynosa in the State of Tamaulipas. Representatives of Petroleos Mexicanos present included: Ing. Antonio Garcia Rojas, chief geophysicist for Pemex; Ing. Paul Perez, F., chief of the exploration department, Monterrey zone; Ing. Roberto Onate, geophysical supervisor, Orizaba zone; Ing. Jose Coffin, geophysical supervisor, Monterrey zone; Ing. Eduardo Prieto Bojorquez, engineer; Ing. Noberto Munoz Malago, engineer; and Dr. Manuel Bernal, company physician. Crews of Geophysical Service, Inc., of Dallas, made the tests.

**G. R. PRESTON** has been appointed manager of the economics department of Cities Service Oil Co., Bartlescille, Okla. He will continue to head up the company's program for acquiring producing properties. Mr. Preston was first employed by Cities Service in March 1925. Five years later he was appointed budget manager and in 1940 was elected assistant treasurer.

G. R. Preston

# SIGMA *Process Pumps*
## FOR OIL REFINERIES



Sigmund Process Pumps are built to the specifications of the leading Oil and Chemical Companies throughout the world. They are designed to deal with difficult pumping problems, where extreme temperatures, high pressures, and corrosive and/or volatile liquids are to be handled. A comprehensive range is available.

*This pumping unit is one of many supplied for Oil Refinery Work.*
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## $24 Million for Shell Research

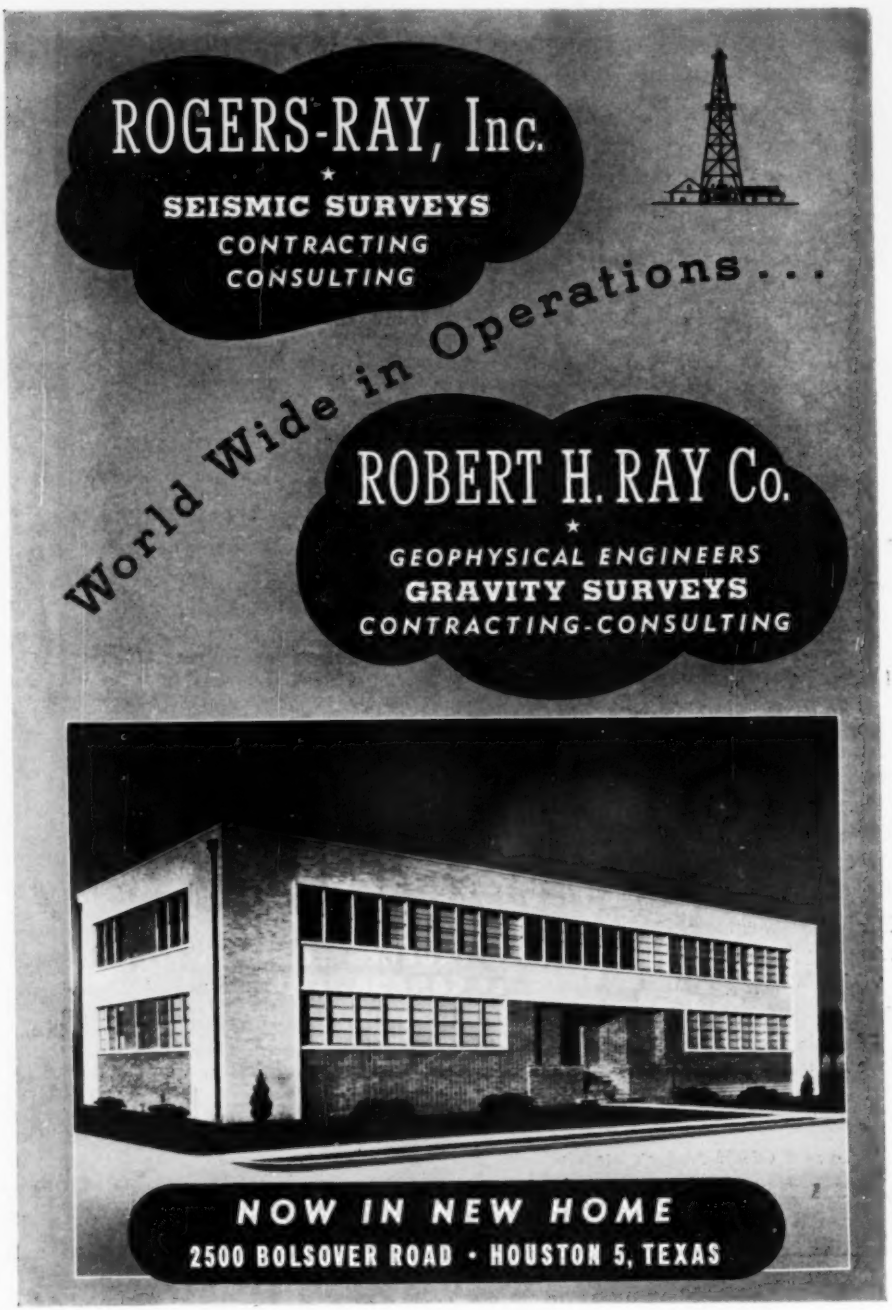
Record budgets totaling $24 million have been adopted for worldwide petroleum research during 1949 by the various Shell companies. The huge sum is intended to finance research in all phases of operations, from seeking new sources of crude oil to improving fuels, lubricants and chemicals. A substantial part of this amount will be devoted to advancing the broad basic research programs carried on by the Emeryville, California, laboratories of the Shell Development Company.

Aviation and agriculture are particularly active and important research fronts, according to H. S. M. Burns, president of Shell Oil Company. The study of fuels and lubricants for jet engines will get increased attention during the coming year. Jet performance has been the subject of intensive investigation at the laboratories for several years, but the rapid development of jet-powered aircraft for military use makes the study of fuels a priority subject at this time, Mr. Burns pointed out.

Because of increasing demands on the world's food supplies, Mr. Burns said top priority was also being assigned to projects which will help grow more and better crops. At Modesto, California, Shell maintains an agricultural laboratory and test farm which serves as a proving ground for oil-derived chemicals, including fertilizers, weed-killers, insecticides and fungicides. Here and at other agricultural research centers abroad, increased study will be devoted to agricultural aids. In a special but related field, additional emphasis will be put on methods to control such tropical insects as the mosquito and the tsetse fly.

In addition to Shell Development's laboratories, other units involved in the program include a Houston, Texas, research center devoted to discovering new and better ways of finding oil and getting it out of the ground; and laboratories for studying the improvement and application of petroleum products maintained by Shell Oil Company at Wood River, Illinois, Deer Park, Texas, and Wilmington and Martinez, California.

Shell companies now employ about 4,000 scientists and technicians in the research field alone, and laboratory staffs in various localities cooperate on major projects.

Jack H. Connors

## RECO Export Manager

Refrigeration Engineering Corp., of Philadelphia, Pa., has appointed Jack H. Connors as export manager in charge of promotion and sales activities. Mr. Connors has had over 20 years' experience in the machinery and refrigeration fields and is familiar with foreign trade practices and marketing. During the war he was the equipment maintenance officer for the U. S. Army Engineers in the China-Burma-India theatre. After leaving the army, he served as chief engineer of the U. S. Department of Agriculture in charge of their tractor program for the government of India.

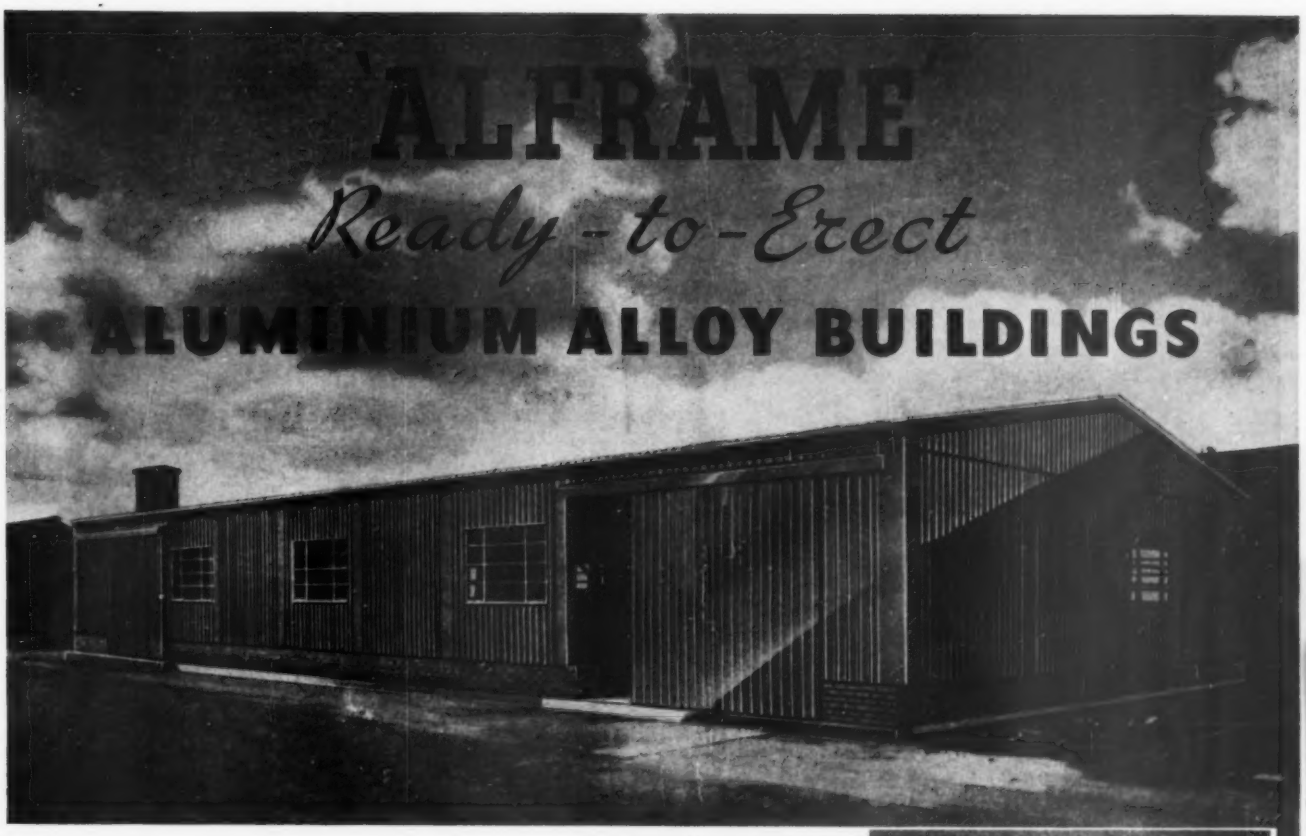
Mr. Connors is now making an extended trip through Central and South America for the purpose of establishing new RECO distributors and visiting those already established in these countries.

## Canadian Pacific to Burn Oil

The Canadian Pacific Railway will convert 100 steam locomotives used in southern British Columbia and between Calgary and Edmonton from coal to oil burning. Fuel oil originating from the newly developed Alberta fields will be used, and installation of wayside facilities for oil operation will be started immediately on the 862 miles of railway in the Kootenay and Kettle Valley divisions in southern British Columbia and along the Calgary-Edmonton run.

## Fluor Announces New Officers

Shirley E. Meserve, general counsel for Fluor Corp., Ltd., since 1929 and its president since the death of P. E. Fluor in 1947, has been elected chairman of the board. Succeeding Mr. Meserve as president is Donald W. Darnell, formerly vice president and general manager, and a member of the company since 1925. The return of J. S. Fluor, Jr., to the company as executive vice persident was announced. W. Earl Dunn, formerly executive vice president, was named vice president and general manager of the engineering and construction division, and J. Robert Fluor, formerly vice president and assistant general manager, was appointed vice president and general matnager of the manufacturing division.

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The "Alframe" provides factory made buildings of standard components of aluminium alloy, easily transported by road or rail. The standard 9 ft. bays (36 ft. clear span) allow buildings of any length to be erected at will. The complete absence of internal supports provides an entirely clear floor area. A standard "Alframe" 72 ft. x 36 ft. can be erected in 24 hours. "Alframes" require no painting or other weather protection and are especially suitable for use in hot climates.

"Alframes" are in use for factories, workshops, storage buildings etc. in many countries. Full information will be sent on request.

*"Alframe" buildings have been supplied to many well known firms including Overseas Food Corporation, The Anglo-Iranian Oil Company, Kuwait Oil Company, Thomas Lipton Ltd. Ministry of Agriculture.*

*The building is erected entirely by hand.*

*Interior of typical Alframe building.*

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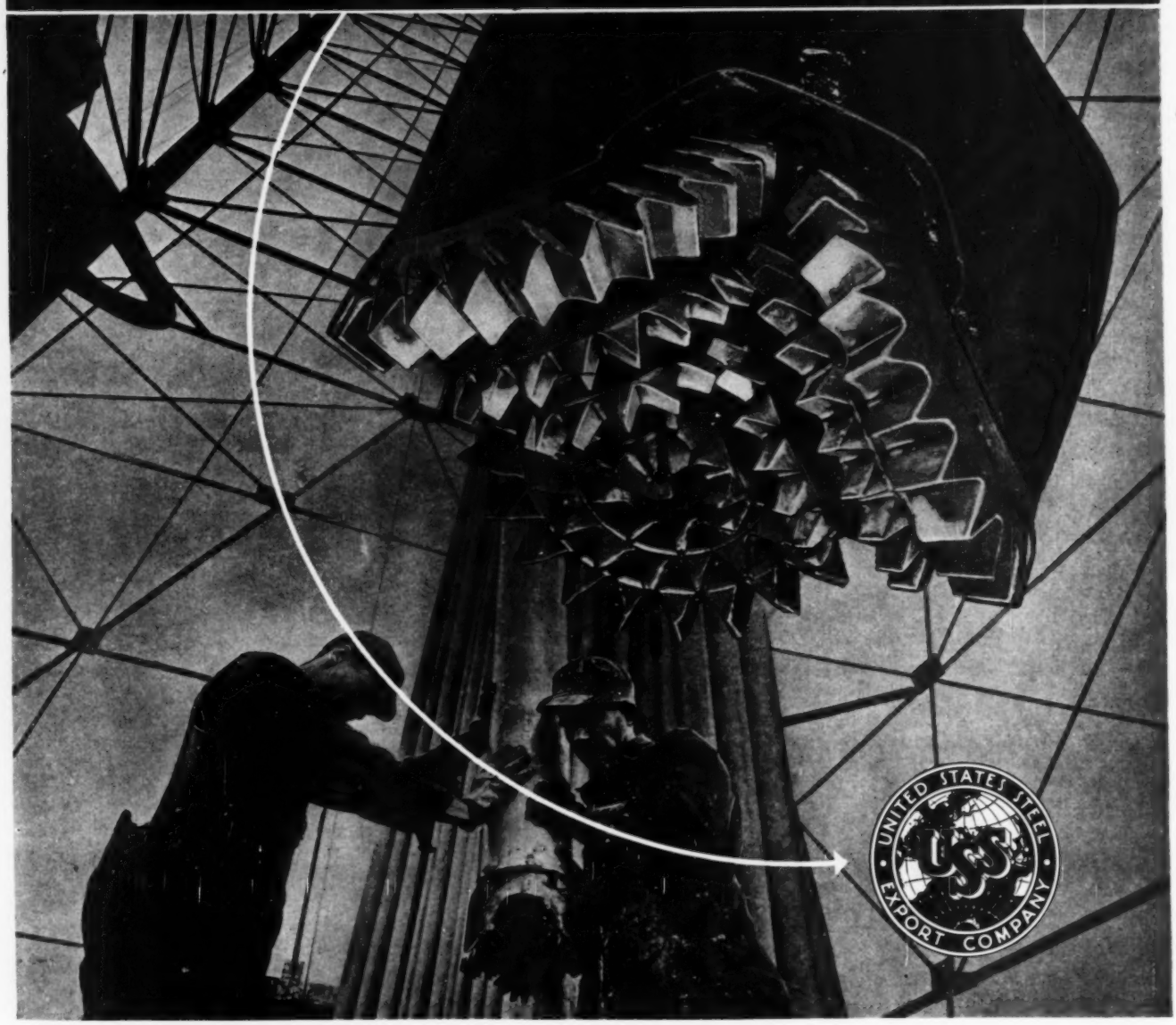


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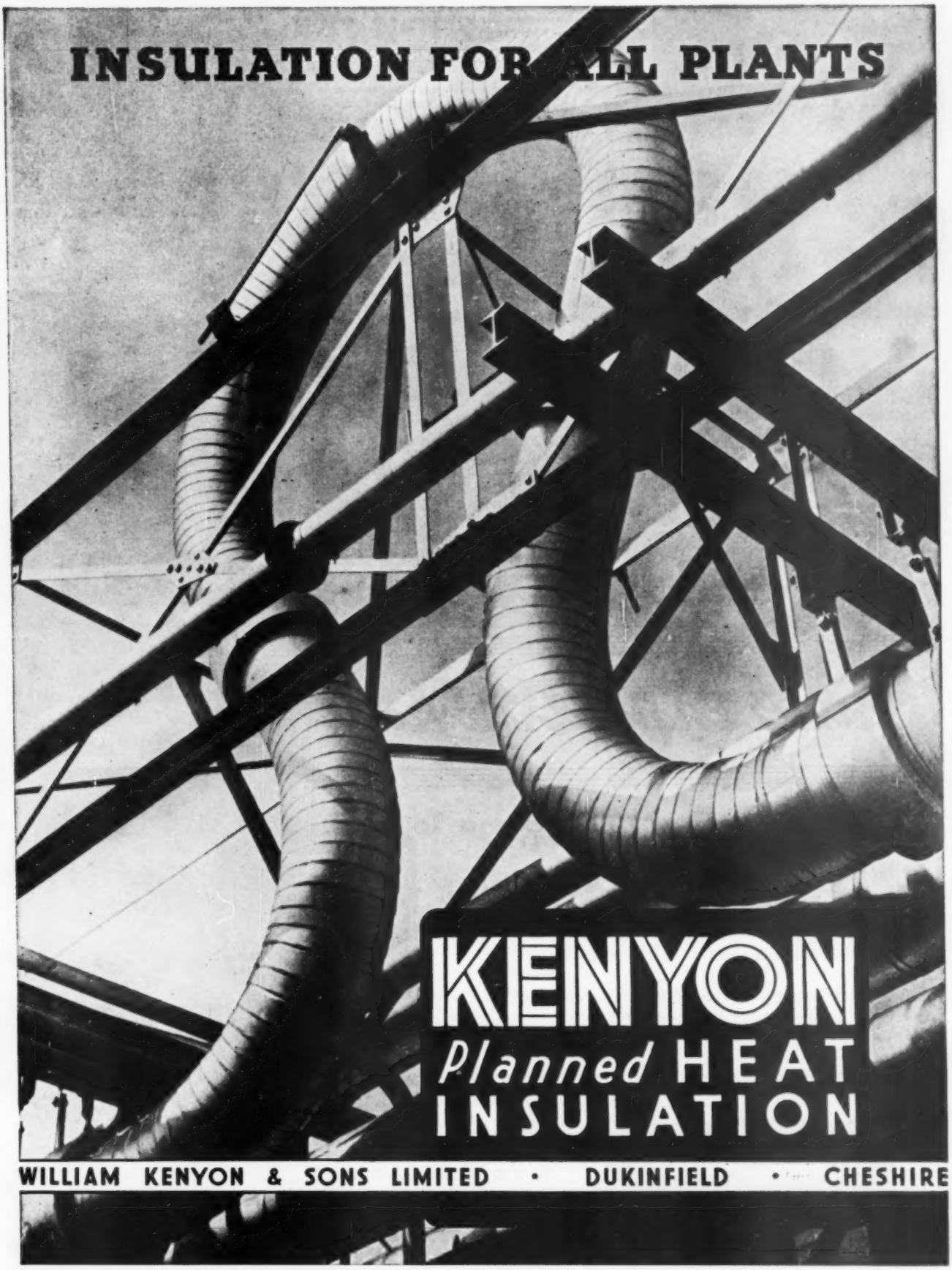
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Lloyd Lynd

**LLOYD LYND** of Bartlesville, has been elected a vice president of Cities Service Oil Co. (Del.) He is at present also treasurer and director of Cities Service Oil Co., Empire Pipeline Co., Cities Production Corp. and Terminal Facilities, Inc., and a director and assistant treasurer of Cities Service Oil Co., Ltd.

He was employed by Cities Service Oil Co. as a junior engineer on Sept. 1, 1919, upon his return from service in World War I. He completed the junior engineer course and was assigned to various departments of the treasurer's division until May of 1928, when he was elected assistant treasurer of Cities Service Oil Co. Elevation to the post of treasurer came in August of 1941.

**ERNEST R. LILLEY** has been elected vice president in charge of the Great Lakes Carbon Corporation's oil and gas division. He continues as its chief geologist and makes his headquarters at the corporation's New York general office.

## Assistant To W. F. Bettis

Norman K. Andrew has been appointed assistant to W. F. Bettis, manager of Johnston Oil Tool Company. He has had 15 years' experience with various types of service tools in California, Texas, Louisiana, Arkansas and Kentucky, and was formerly an instructor in the College of Engineering at the University of Southern California. He has been with the Johnston organization for the past ten years, except for the time spent in war service. Mr. Andrew is an active member of the Tuesday Export Luncheon Group of the Los Angeles Chapter of Nomads and devotes a great deal of his time to foreign oil men.

## M. A. Schenk Retires

After 28 years' service with Shell companies, M. A. Schenk has retired. Since July 1947 he has been advisor to Ir. W. A. van Gelder who succeeded him at that time as manager of the purchasing department at The Hague, a position he had held since 1931. Mr. Schenk organized the New York purchasing offices of Royal Dutch-Shell in 1924 and remained as manager there until 1931.

## API Meeting

Directors of the American Petroleum Institute have decided to hold the annual meeting of the current year in Chicago, November 7-10. The 1950 meeting will be held in Los Angeles, Calif., November 13-16.

## Industrial Truck Catalog

A catalog describing Electric Eel industrial trucks has been published by Steels Engineering Products, Ltd., Sunderland, England. The trucks are designed with "instinctive steering" which uses natural, instinctive, directional body movements to control direction of travel. Result is that trucks may quickly traverse congested plant space with heavy loadings. Thirty and 50 Cwt. trucks are described in the bulletin available by writing the company.

**ELECTION** of B. W. Letcher to the board of directors of Standard Oil Co. of California, has been announced by H. D. Collier, board chairman. Mr. Letcher started with Standard in 1911 as a clerk in the manufacturing department. He later became chief clerk in the general office, then assistant general auditor and in 1926 was made general auditor. He was elected secretary and comptroller in 1940 and a vice president in 1944. Recently he has devoted most of his time to Standard's foreign interests.

B. W. Letcher

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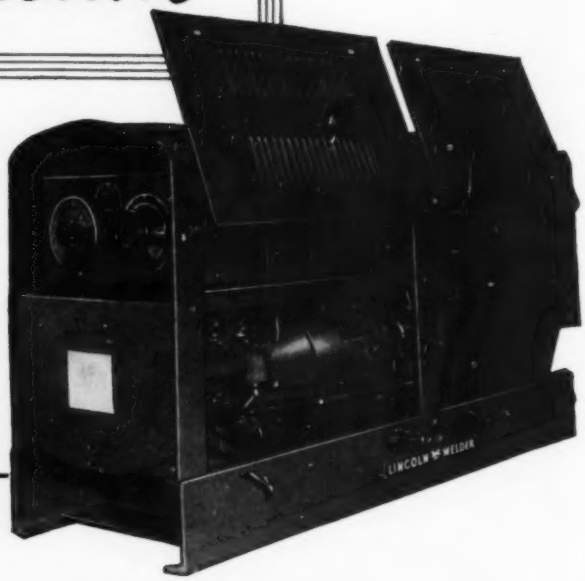

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DUPONT TETRAETHYL LEAD COMPOUNDS

Metallographic examinations are made to study valve deposits and corrosion.

Examining surface condition of valve.

Checking compression pressures to determine condition of valves undergoing test.

# Du Pont Research

## at work on the problem of prolonging valve life

The ultimate objective of all Du Pont research on tetraethyl lead and other anti-knock agents is the improvement of fuel performance and fuel utilization. Starting point for this research is a better understanding of the action of fuels in internal combustion engines.

One such study of broad significance is devoted to investigating the effect of combustion on engine valves. Exhaust valves, especially, have always presented certain problems in design and operation because of the severe conditions under which they must operate. The many variables of fuels, lubricants, design and operation which can affect valve life are being investigated.

This is another example of Du Pont research at work on problems of mutual interest to the refiner and automotive manufacturer.

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# *Research*... To Help Every Refiner

In the present valve investigations, Du Pont chemists, engineers, and metallurgists are seeking answers to the problem of improved valve life. Fundamental studies of valve corrosion and deposits as well as the many other factors that can affect valve operation are being made.

This and other Du Pont research projects are aimed at gathering information on problems of vital concern to all refiners, information which will also contribute to better fuel additives and improved fuel quality, today and in the future.

**Metallographic examinations are important in the study of valve deposits and corrosion. The photomicrographs below are a few made in the course of these studies.**

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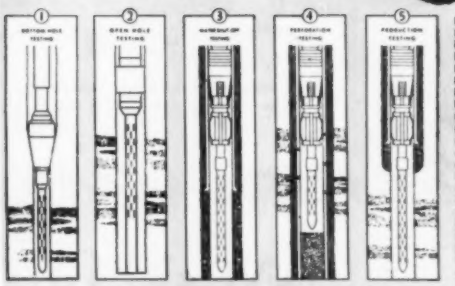
## FOR PREVIEWING WELL POTENTIALS

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The Johnston Formation Tester is relied upon by operators throughout the world for determining the productivity possibilities of sands encountered in drilling wells as they are penetrated without the expense of setting casing. Its wide range of applications makes it adaptable to every formation testing job on the lease and provides the ultimate in tester accuracy and safety.

For complete information on the time and money-saving advantages of Johnston Testing Methods and Equipment write for illustrated brochure.

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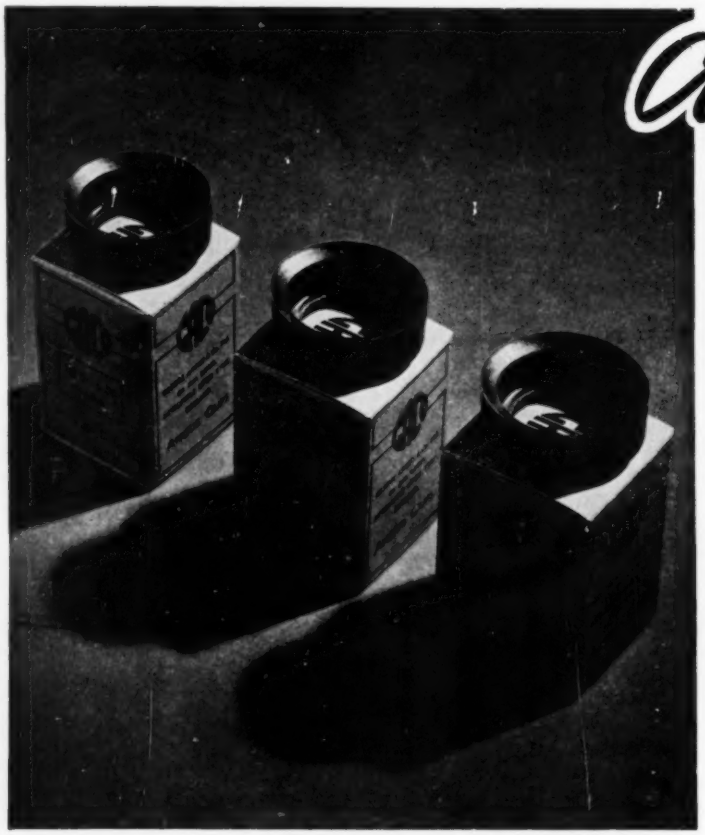

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**Layers of fabric are impregnated with "Gaco" and moulded under heavy pressure to form a tough compact composition capable of resisting the action of abrasion, crude oils and gases at high working pressures and temperatures.**

**Years of intensive research are behind the development of Angus Cups. Supplied in three hardnesses, sizes as laid down by A.P.I. standards.**

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This illustration conveys but an impression of flash Fractionating Towers that Harveys have been producing for their overseas customers. Recent orders include Vessels 110 ft. high by 25 ft. in diameter, weighing up to 125 tons.

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## Nomads Honor DeGolyer and MacNaughton

At a recent meeting of the Dallas Chapter of Nomads, E. DeGolyer and Lewis MacNaughton, Dallas, were awarded honorary memberships for distinguished service in a geological capacity. In the picture above, Mr. DeGolyer receives parchments from Brad Mills, president of the Dallas Chapter. Mr. MacNaughton was unable to attend.

At the same meeting Jim Herrick, Cardwell Manufacturing Co., Wichita, Kansas, spoke and showed a remarkable series of pictuers made on a trip extending from Labrador to the Hawaiian Islands, via England, France, Italy, Greece, Saudi Arabia and the Malayan region.

## Unit Operation of Oil Fields

A book of unusual interest to the petroleum executive, lawyer, engineer and members generally of the oil and gas industry, as well as public officials, has been published under the title, "Anti-trust Laws, et al. v. Unit Operation of Oil or Gas Pools." The author is Robert E. Hardwicke, of Fort Worth, Texas. The publisher is the American Institute of Mining and Metallurgical Engineers.

The volume of 300 pages traces the history of the conservation movement which, Mr. Hardwicke says, received a strong stimulus in 1924 when Henry L. Doherty asserted that oil production practices were wasteful and that the only adequate remedy was unit operation under federal laws.

An account is given of efforts to solve the problems, including the activities of federal and state governments and of oil industry organizations. The author discusses in some detail the factors which cause the present unusual interest in unit operations, voluntary and compulsory, especially with respect to condensate gas pools and all types of secondary recovery operations.

The analytical discussion of the problems and the solutions suggested, with special emphasis on the effect of antitrust laws and other laws, state and federal, is profusely documented. Many cases and statutes are cited. The citations constitute an excellent bibliography of historical and legal phases of unit operations.

The low price of the book was made possible because Mr. Hardwicke generously donated the manuscript to the AIME, and the book was published under the sponsorship of the Henry L. Doherty Memorial Fund, with the cooperation of the Cities Service Co.

Antitrust Laws, et al. v. Unit Operation of Oil or Gas Pools, by Robert E. Hardwicke; 300 pages; published by American Institute of Mining and Metallurgical Engineering, New York, 1949; $1.50.

## Form Science Club

Chemists and engineers of the Standard Oil Co., (Ind.) have formed the Whiting Science Club to broaden the technical background of its 350 members. Dinner meetings five times yearly are addressed by authorities in various scientific fields. Present officers of the club are: Phillip Hill, president; Howard Parker, vice president; and Marvin DenHerder, secretary treasurer.

## Opens Store at Hays, Kansas

T. D. Collins, vice president Ideco Mid-Continent direct sales, has announced the opening of a new Ideco oil field supply store located at Hays, Kansas, E. E. Keating has been appointed as store manager. This new installation will be operated under the direction of the Kansas district manager, R. R. "Lefty" Matthews.

## New Products Department

A new product development department has been formed by the American Cyanamid Co., with George W. Russell as manager. One of the functions of the new department will be to determine whether there are economic uses for selected products which have been developed in Cyanamid's research laboratories, for which sales applications are not yet established.

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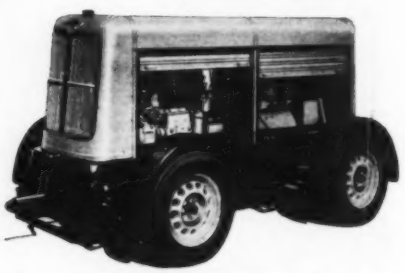
PROTECT THIS VITAL PIPELINE

Vokes filters fitted in one of the main Pumping Stations

**In 1934 VOKES filters were chosen in the face of worldwide competition for the £10,000,000 Iraq Petroleum Company's pipeline from Kirkuk to Tripoli and Haifa. Since that time they have operated continuously in conditions of torrid heat and severe sand storms and are still giving perfect trouble-free service in the protection of electric generators, compressors, portable welding sets and subsidiary machines. Little wonder that VOKES are again providing filtration equipment for the duplicate pipeline.**



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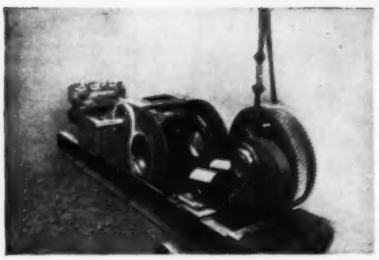
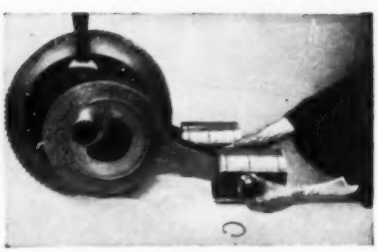
**carefully designed for easy maintenance and simple servicing**



**Dismantling the Connecting Rods of a 5′ x 6′ Oil Country Pump**

Illustration shows the cast steel crankshaft gearing, connecting rods and crossheads removed.

The forged steel connecting rods slide off the eccentrics.



Remove circlips with special pliers, push out the hardened and ground crosshead pins and remove crossheads.

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Yet we must face the sobering fact that right here at home there are plenty of people who are working to curtail, and eventually to abolish personal freedom, and substitute rigid central controls over our activities. Too often these misguided groups and individuals work harder at their self-appointed tasks than do we who think we prefer freedom.

We as business men, above all others, perhaps, have a responsibility in this matter which we can ignore only at the peril of our own survival.

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## Engine Booklet

Industrial engines and equipment for their operation on gasoline, kerosene, distillate or natural gas in a wide variety of applications are described by International Harvester Company in a new 12-page catalog covering four carburetor-type engines. The "inside story" of International exclusive design features is told through sectional views. Quick-read charts reveal horsepower, torque and fuel consumption at various engine speeds for each model. Other illustrations show job-adapted units suitable for such work as pumping crude in the oil fields or water for irrigation, powering sawmills, rock crushers, cotton gin equipment, compressors, feed mills—even carnival thrill rides. Specifications and dimensions are given for each of the four engines.

Copies of the booklet, A-164-MM, "International Carbureted-Type Engines and Power Units," are available on request from International Harvester Company, 180 North Michigan Ave., Chicago 1, Ill.

## World Tour in Oil

Entertaining as well as informative is the booklet, "A World Tour in Oil," written by Dr. Alfred M. Leeston, of Dallas, Texas. It is more than just a handy pocket-size world oil atlas, although it contains basic statistics and general maps which make it useful for that purpose. Dr. Leeston has presented his brief essays on the important oil countries of the world so chattily and with such regard for capturing the other ingredients beside oil which make a country significant and of interest that he achieves his purpose of taking the reader on a personally conducted tour which is an inspiration to further study. The booklet is well integrated and progresses logically and easily from area to area and country to country. Oil's position in the world economy as a whole is the warp upon which he weaves the woof of variegated pattern provided by the individual countries. Included are recommended books for detailed reading. These, together with apt quotations, both prose and poetry, some unique oil legends and pertinent political comments, make it a surprisingly stimulating little book for one covering so much territory in such concise form.

The author is well qualified as guide for such a tour. A native of Germany but a citizen of the United States, he studied law and economics at the Univers[illegible] of Bonn on the Rhine and received his PhD in p[illegible] international law at the University of Cologne. [illegible] expert in foreign trade relations, he has trave[illegible] throughout the world and has written many economi[illegible] articles and published several books. He has served on a Texas commission to promote understanding with Latin America. At present he is lecturer on International Trade at Southern Methodist University at Dallas, and is assistant in economic and foreign work to E. DeGolyer, the famed economic geologist and international oil consultant.

"A World Tour in Oil," by Alfred M. Leeston. Published in Dallas, Texas, by Dr. A. M. Leeston, Continental Building; 35 pages; 50 cents.

**Petroleum Production,** Vol. 5, Oil Production by Gas Flooding; by Park J. Jones; 280 pages, illustrated. Published 1948 by Reinhold Publishing Corp., New York, $6.

This volume completes the series of books on petroleum production. Previous volumes have the titles: Mechanics of Production; Optimum Rate of Production; Oil Production by Water; Condensate Production and Cycling.

The contents of the new volume are presented in three parts. Part I: Foundations; reservoir characteristics; displacement of oil by gas; separation and plant extraction; vaporization in oil reservoirs; pressure maintenance with gas; declining reservoir pressure; oil recoverable by flooding. Part II: Oil production by gas; radial reservoirs and traps; linear reservoirs and traps. Part III: Oil production by flooding; economics of flooding. Appendix, tentative K values for oil, index.

The treatment is based on known characteristics of reservoirs and their content of oil, gas and water, which can be defined, explained and treated mostly with simple mathematics in a way which should enable the petroleum engineer to lay out and direct recovery programs.

## Fuel Oil Standards

Printed copies of Fuel Oils (Sixth Edition), Commercial Standard CS12-48, are now available, according to announcement by the Commodity Standards Division of the National Bureau of Standards. Copies may be obtained from the Superintendent of Documents, Government Printing Office, Washington. 25, D. C. The price is ten cents per copy.

## Purchases Under ERP

Under the European Recovery Program it was reported that up to Nov. 27 last the Economic Cooperation Administration had expended $21,990,590 for petroleum for use in the 19 countries covered by the Marshall Plan. The quantity involved was 9,744,073 barrels, and the price paid ranged from $1.91 to $3.34 per barrel, according to quality. Supplies came from the United States, Venezuela, Kuwait, Saudi Arabia and Iraq.


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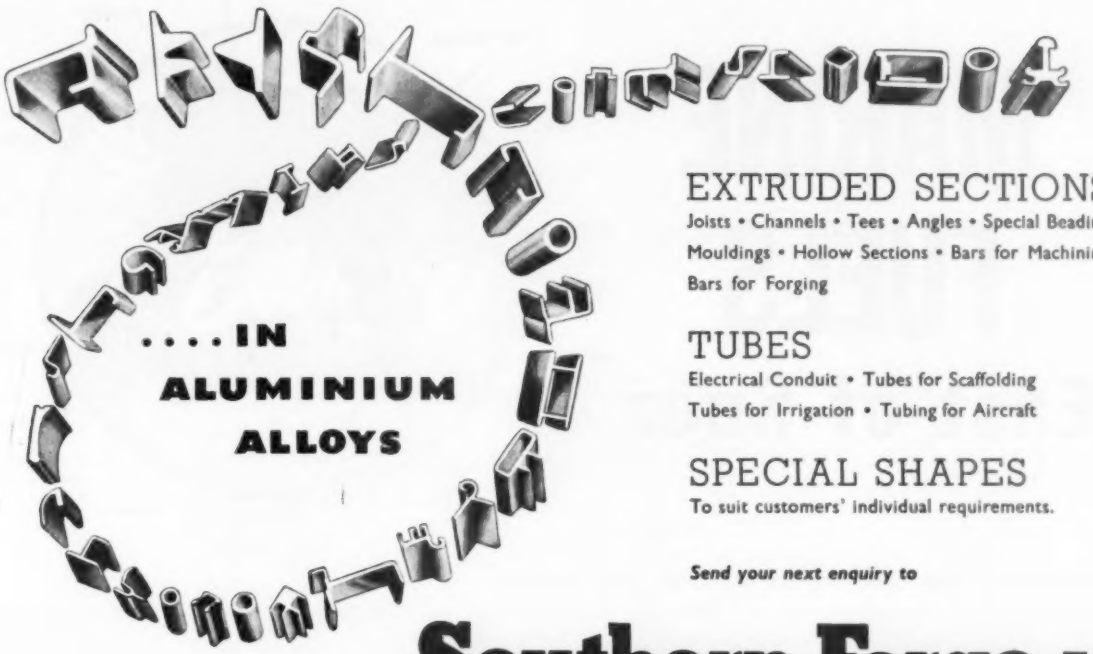


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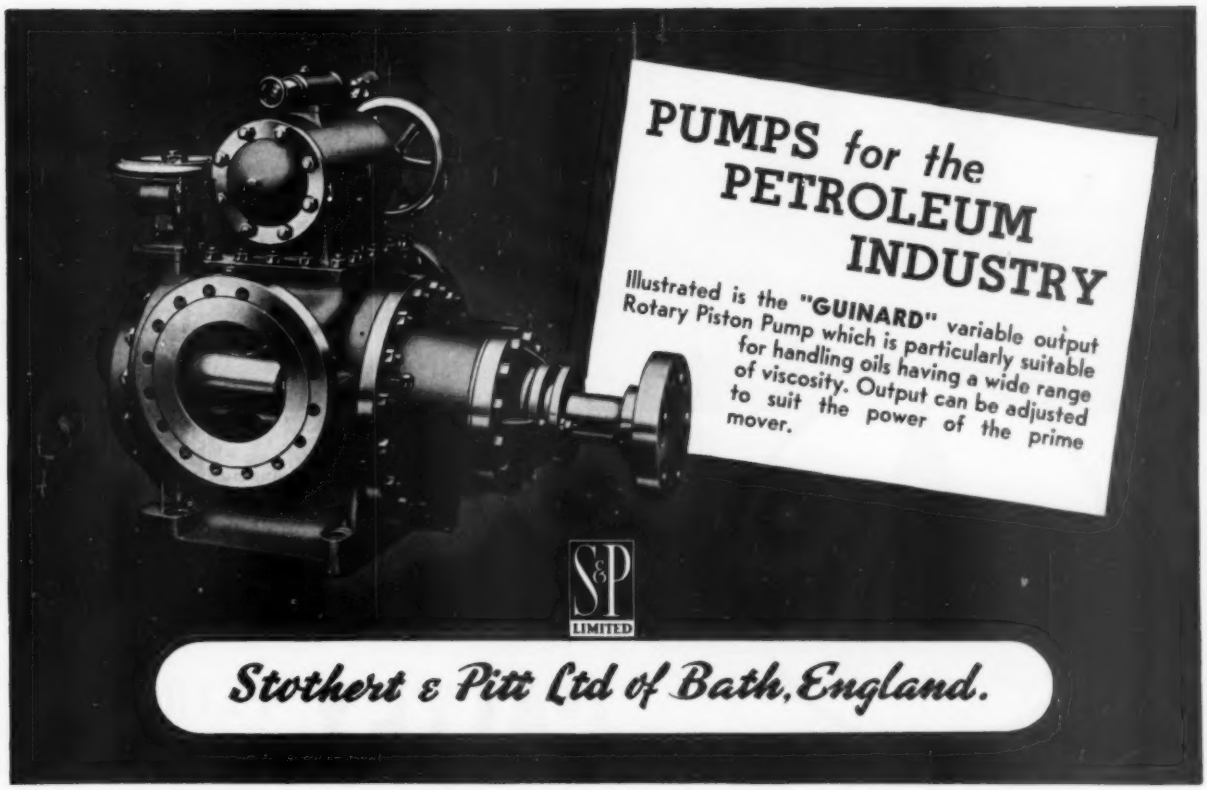
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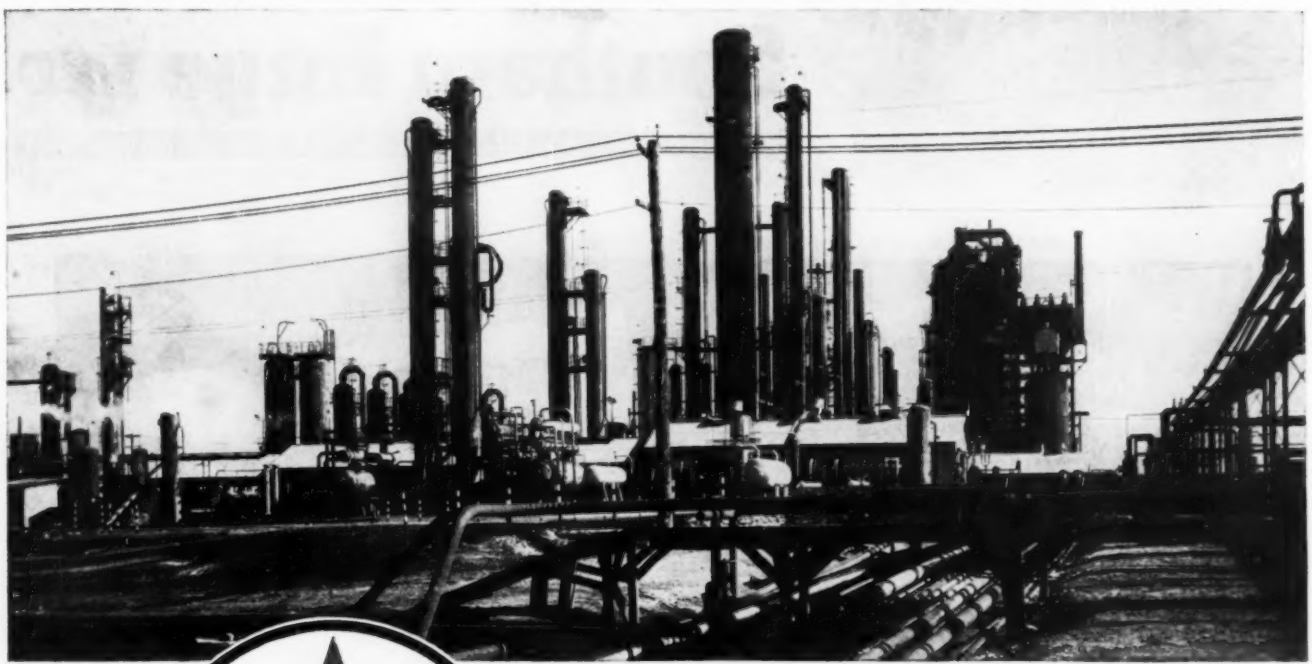

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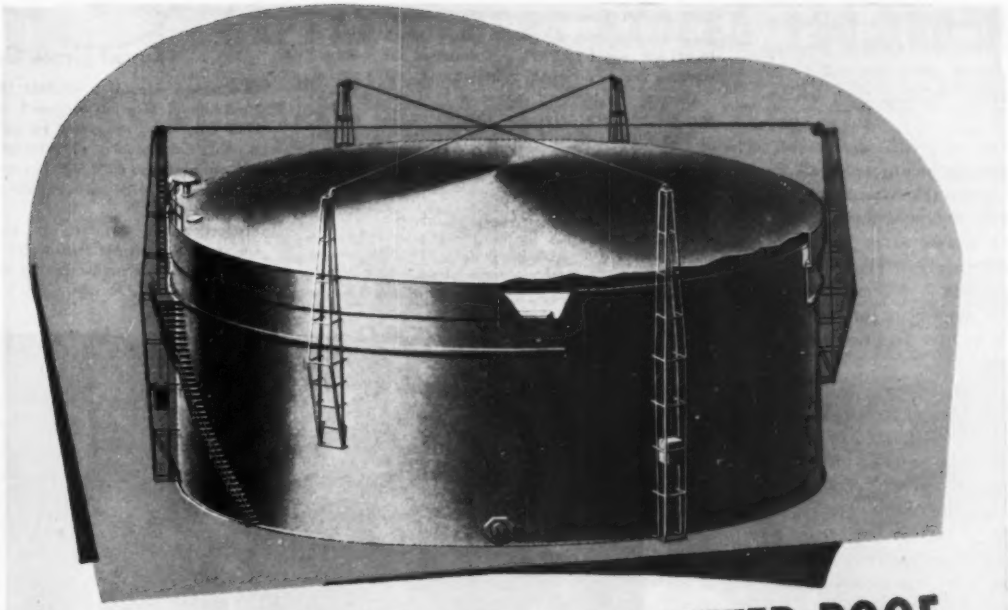

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## Steel Supply Overtaking Demand

*(Continued from page 47)*

as the oil and gas industry is concerned has been the stepping up of production of tubular goods to meet the extraordinary requirements for oil country goods and line pipe. Although production of drill pipe will probably be at a level sufficient to meet the 1949 well-drilling program of the petroleum industry, there may still be individual hardship cases resulting from maldistribution.

"As to line pipe, the continuing abnormal demand—particularly as to the natural gas segment—should lead all integrated and non-integrated pipe mills to operate at as high a capacity as the available supply of plate will permit. The present problem is to determine what can be done to secure more plate for such non-integrated pipe mills as have facilities for API specification line pipe."

As far as the overall steel supply is concerned certain trends are evident. Mill production was above 8,000,000 tons in January, an increase of nearly 10 percent over the corresponding month of 1948, and points to a probable output for the current year of over 95 million tons. Statistics indicate an encouraging near-balance in steel supply for most products, line pipe being the principal exception. Decline in scrap metal prices shows that supply of that material is improving. The gray market has gone and conversion agreements are going. Export demand, except for large-diameter pipe, is declining. The fact that allotments under the voluntary allocations program are not being fully absorbed points to the steady transition from a sellers' to a buyers' market.

## Warren Petroleum Report

Warren Petroleum Corporation and subsidiaries report net income for the six months ended Dec. 31, 1948 of $5,005,969, equal to $2.95 per share on the 1,699,450 common shares outstanding at the end of the period. This compares with net income of $3,865,633, or $2.27 per common share for the like six months a year earlier. Net sales and revenue for the six months totaled $50,921,679 as compared with $36,412,526 for the six months ended Dec. 31, 1947.

## Shale-Oil Patents Listed

Publication of the first substantially complete listing of American and foreign patents on shale-oil products has been made by the U. S. Bureau of Mines. The list includes all patents found on the records in the U. S. Patent Office up to Jan. 1, 1945, with illustrated short descriptions of each claim. Bulletin No. 467, "An Index of Shale-Oil Patents," compiled by Simon Kloskey, Bureau of Mines research analyst, may be obtained from the Superintendent of Documents, Government Printing Office, Washington 25, D. C., for 75 cents. It is not for sale by the Bureau of Mines.

## Kuwait Crude Output

December crude oil production in the Persian Gulf Sheikdom of Kuwait amounted to 885,408 tons, the Gulf Oil Corp., announced on behalf of the Kuwait Oil Co., Ltd., London. Total production for the year 1948 amounted to 6,291,577 tons which is equivalent to approximately 46,500,000 barrels of crude oil.

Production for the last six months of the year amounted to 4,260,443 tons, an increase of more than 200 percent over production for the first six months, which was 2,031,134 tons.

Officers of Tulsa chapter Nomads for 1949, seated, left to right: Mitchell Tucker, Kenneth O. Hoevel, H. M. Cooley, George Davidson. Standing, left to right: Amos A. Roberts, Opie Dimmick, Clair Nabors, Anthony Gibbon, H. M. Cosgrove and M. D. Gilbert, retiring president.

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**14th REPEAT ORDER FOR GOLDFIELD.** Ashanti Goldfields Corporation Ltd., have recently placed yet another order for Crossley-Premier Engines. The new engine is a 1100 B.H.P. Oil Engine and will be the 18th Crossley-Premier Engine in their power plant.

**12TH REPEAT ORDER FOR AUSTRALIAN MINE.** One of the seven new oil engines now on order for the New Consolidated Gold Fields, Ltd., is for The Lake View and Star, Ltd., and will be the twelfth repeat order for this mine.

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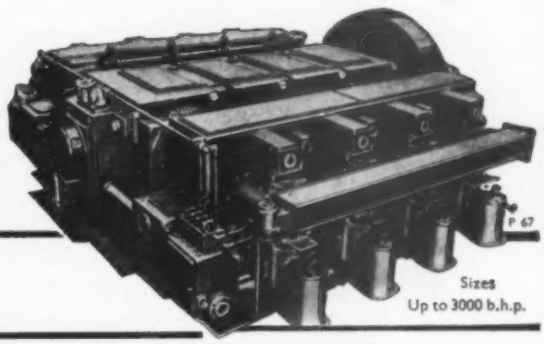

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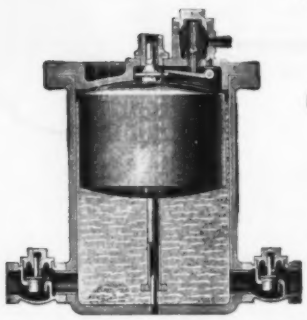

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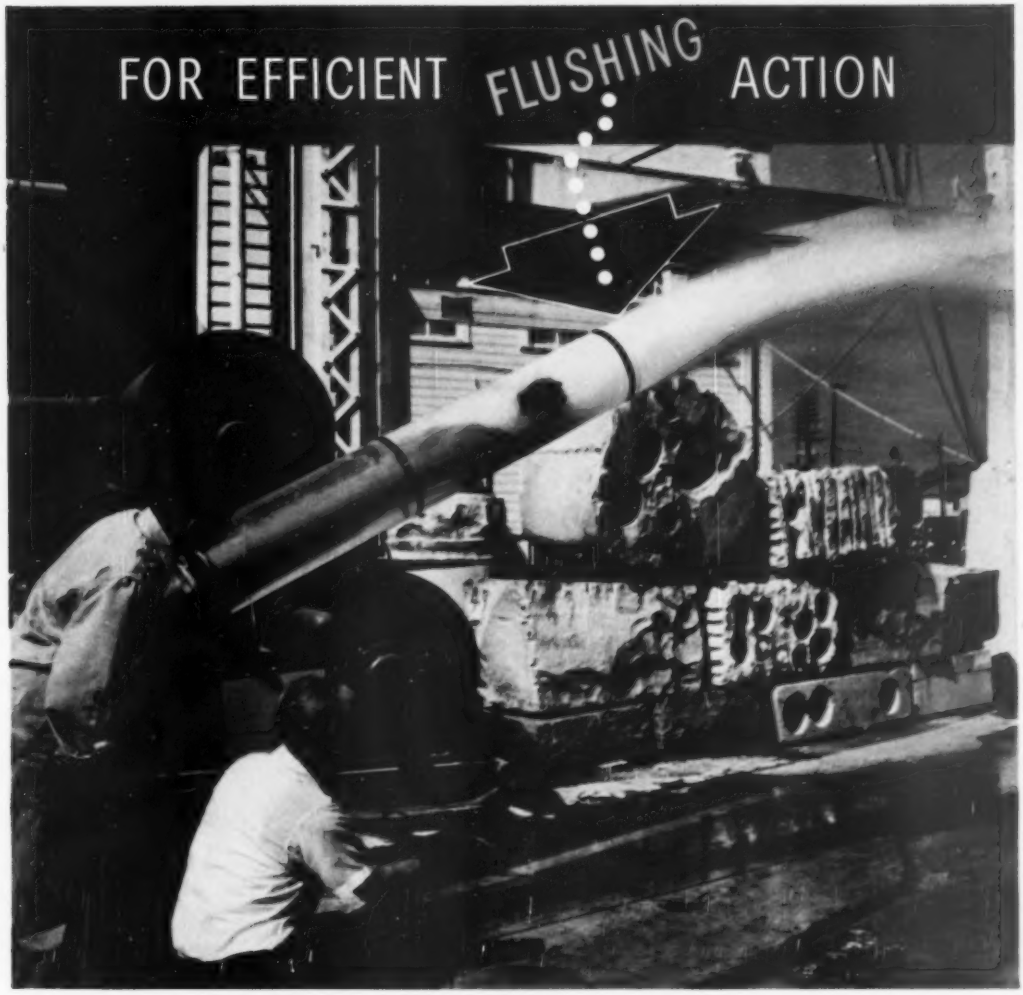


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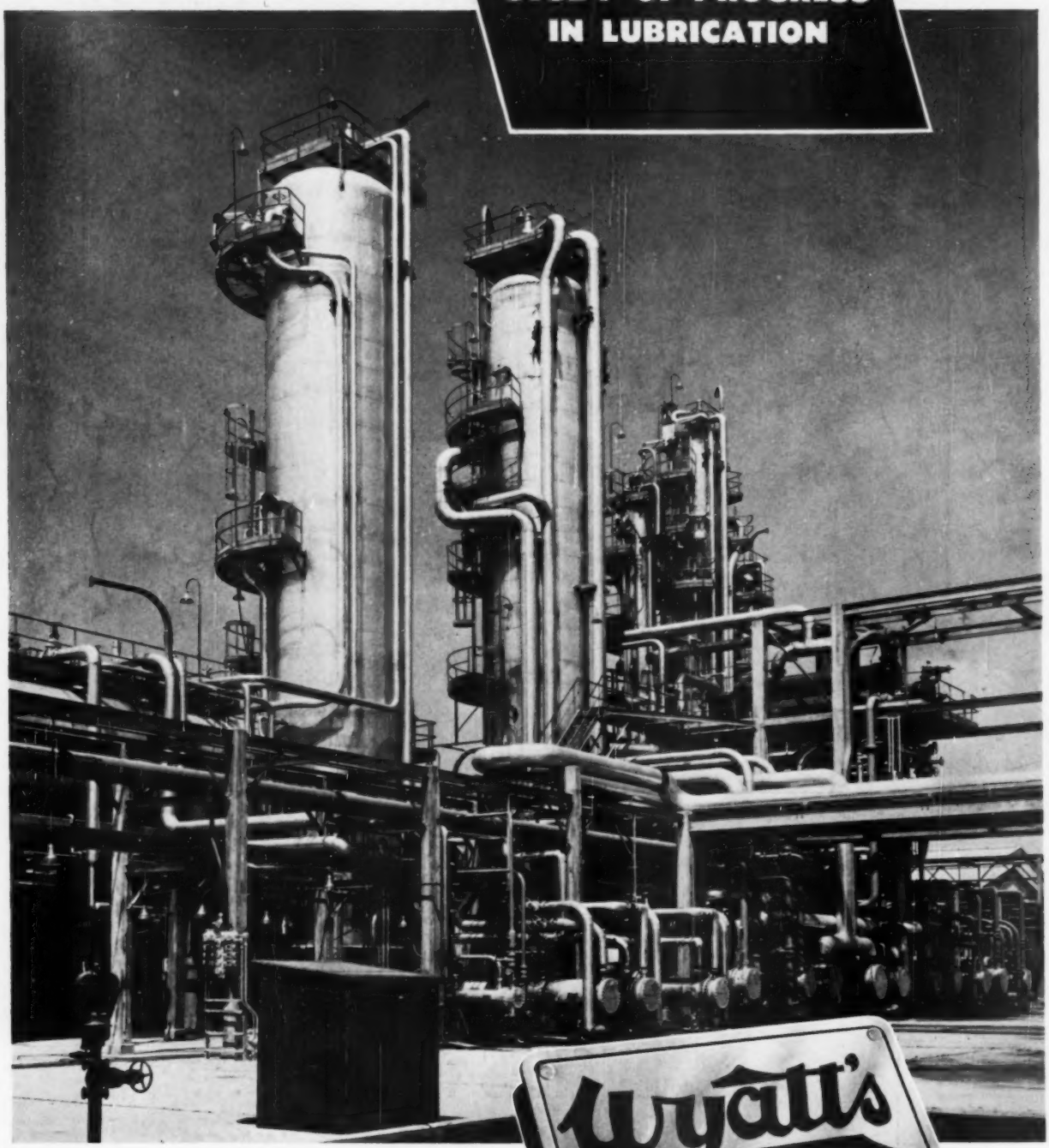

Phenol extraction unit in lube oil plant on the Gulf Coast . . . a picture of modern fabricating by Wyatt Metal & Boiler Works for a major engineering construction company.

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